FORESTRY ABSTRACTS

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A TIME STUDY OF MANUAL LOGGING OPERATIONS

DURING the past few years several contributions have been made to the study of the efficiency of manual work in European forests, e.g. the papers by Hilf [*For. Abstr.* 5 (261), 6 (121)], Seppänen [*For. Abstr.* 5 (261)], and the Swedish studies summarized in *For. Abstr.* 5 (81–3). The results have now been published of a Danish time study* which helps to clarify the relative importance of the various phases of logging work and the many factors involved, and should suggest useful lines of approach for further studies.

The timings are derived from 23 sample operations each involving the felling and initial conversion of timber in the woods by two-man gangs, and all the figures here quoted refer to the times of two men working together. The observations, extending over the equivalent of 150 working days, covered only thinnings in representative Beech woods aged up to 120 years, and in a few instances somewhat older, in 5 different forest districts.

CLASSIFICATION OF TIME.

The working day (*Dagtid*) is classified as meal times + other pauses (*Spisetid og andre Pauser*), which include receiving instructions or pay, shifting the rest cabin, standing by while measurements are being made, etc., and working time (*Arbejdstid*), which is subdivided into actual working time (*Værktid*), breaks (*Ophold:* mainly 'breathers'), and intervals (*Mellemtid:* the time spent in moving from one job to another). On the basis of all the operations studied, mean daily values for these divisions were: working day 8 hrs. 36 mins., meal times and other pauses 1 hr. 38 mins., and working time 6 hrs. 58 mins., of which approximately 2 per cent. was breaks, 5 per cent. intervals, and 93 per cent. actual working time (the last-named thus amounting to about 75 per cent. of the working day).

WORKING TIME.

As, in some cases, the wood cut had to be conveyed by the gangs to a road, and not merely sorted, assembled and stacked on the felling site, it was decided to regard a job as finished when the men had 'delivered' the cut products. The chief phases of the work were felling, trimming, cross-cutting, cleaving, assembly and stacking of products, and special work (the last-named including repair and maintenance of tools). Under the varied conditions of the samples, it is considered that the most satisfactory figures for comparison are given by the working time per cu. m. of merchantable material. The quality of the work was regarded as satisfactory in this investigation, possibly owing in part to the workers' knowledge that results were being checked, but quality (especially adherence to specified stump heights, directions on the kind of produce to be cut, etc.) is a factor that would have to be taken into account under some conditions. Various factors influencing working time are considered in the detailed analysis of results, but particular attention is given throughout to the comparative decrease in working time with increasing diameter of stems (due chiefly to reasons detailed below, under '*Working Conditions*') as illustrated by the following table:—

Age in years	*Diameter in cm.*	*Working time of two-man gang per cu. m. of merchantable material*
50	20	2 hrs. 10 mins.
50–80	20–30	1 hr. 50 „
80–110	30–40	1 „ 30 „
110	40	1 „ 10 „

For all the sample operations, the average working time per cu. m. was 1 hr. 34 mins.

* GANDIL, C. Analyser af skovningsarbejde. Et bidrag til skovbrugets arbejdslære. [Analyses of logging work. A contribution to the study of work and time in forestry.] *Dansk Skovforen. Tidsskr.* No. 8, 1945 (261–372). [Dan.]

WORKING CONDITIONS.

(i) *Weather:* A light black frost is regarded as the best working weather. Heavy frost causes delays due to cumbersome clothing, foot-stamping, etc., difficulty in driving posts for stacks, and difficulties in working on frozen wood and wood damaged by felling on to frozen ground. Deep snow impedes movement and may have to be cleared from material already felled and from stacking sites. Glazed frost and high wind are also clearly unfavourable. Examples of the influence of weather conditions during the study are quoted, but their quantitative effects were obscured by variation in the other factors.

(ii) *Terrain and soil* were not important factors in the areas concerned.

(iii) *The cut:* In general, working times per cu. m. were shorter for the better site qualities and higher diameters, the main reasons being that the branch/stem volume ratio decreases with increasing age and height, sectional area increases at a slower rate than height, and finally there is less work in cutting one large log than several smaller ones totalling the same sectional area. The actual volume of the cut also has an important effect in that a heavy cut means less dispersion of effort and, in particular, less walking about during the various phases of the job. Under the conditions of the study such effects were observable only as trends, owing to the interaction of other factors, but the following example may be quoted: gangs 15 and 17 were both working in stands approximately 40 years old but on site qualities II.1 (height 13·3 m., diam. 13·6 cm.) and 0·5 (height 17·9 m., diam. 19·9 cm.) respectively, whence it might be expected that the former gang would have the longer working time: in practice, however, the times were almost equal, and this is in part explained by the differing volumes cut (percentage cuts 17·6 and 6·8, respectively).

(iv) *Assortments:* It is clear that working times will be affected by the lower limit of utilizable material and the proportions of different classes of produce cut from the felled tree, which will depend chiefly on the type of material available, the market for the various kinds of produce, and the owner's or manager's policy in relation to these. The assortments are not entirely standard from place to place, but apart from this and some other variables, the following table gives a general indication of the effect of assortments on working times:—

MINUTES PER CU. M.

	Felling	*Trimming*	*Cross-cutting*	*Cleaving*	*Assembly and stacking*	*Total*	*Piece-work Price by consumption of time (Cleft fuelwood = 100)*	*Piece-work Price by labour contract (Cleft fuelwood = 100)*
Gang 1.								
Long logs*	11·9	2·4	—	—	—	14·3	14·6	50
Short timber (cleft or round) ..	„	„	55·6	11·2	11·8	82·9	94·5	102
Cleft fuelwood	„	„	„	„	17·2	98·3	100·0	100
Large round fuelwood ..	„	„	„	—	17·2	87·1	88·6	114
Small round fuelwood	„	„	85·5	—	25·4	125·5	127·5	136
Gang 2.								
Short timber (cleft or round) ..	14·2	3·3	45·0	9·2	18·9	90·6	97·4	102
Cleft fuelwood	„	„	„	„	21·5	93·2	100·0	100
Large round fuelwood	„	„	„	—	21·5	84·0	90·3	114
Small round fuelwood	„	„	61·5	—	28·0	107·0	115·0	136
Gang 4.								
Small round fuelwood	13·5	5·1	40·4	—	20·9	79·9		
Industrial fuelwood	„	„	„	32·6	15·6	107·2		
Gang 5.								
Industrial fuelwood	21·9	8·8	40·9	26·4	27·1	125·1		
Gang 6.								
Industrial fuelwood	26·7	11·4	44·6	32·7	22·7	138·1		

* The designations of the assortments are approximate renderings only.

It is also evident from this table that the labour tariff for cutting into long logs (*Kævler*) is a very favourable one for the workman in comparison with other assortments, and this finding agrees with general opinion. In any case, the figures given above, and others from particular operations, show that the question of assortments and working times for their production is important to the forest manager.

(v) *Removal of produce from the stand:* Where the smaller cut products were taken to a track or road the workmen either performed this task themselves, or a horse and waggon were employed. Long logs were never taken out by the loggers, so that in areas where they were produced there was a saving of time in this phase of the work. For the smaller products a horse and waggon appeared to be less economical of time than hand labour, but conditions were too varied to permit of general conclusions.

THE WORKERS.

The men were of varied age and experience, and some were pupil foresters. No conclusive results are given in this section, except that the pupil foresters' lack of experience somewhat increased their times for certain operations.

TOOLS.

The discussion on tools is of a general nature, as the variations in the age of trees dealt with and in the tools used was too great for exact comparisons. It is emphasized that the choice of tools is largely a personal matter and that woodmen are often conservative in their tastes: it is by no means enough to determine the best tools for the job, but the men must know of them, and know how to use and maintain them.

METHODS OF WORK.

These were as varied as the tools used and are the subject of a broad discussion in this section under the headings: number of trees worked on at a time, sequence of phases of the work, co-operation between the men in a gang, and systematic arrangement of the work.

THE DIFFERENT PHASES.

The remainder of the report consists of details of the separate phases of the work.

(i) *Felling* occupied an average of 15·8 per cent. of the working time for all phases and showed the greatest delays from 'breaks' and 'intervals', the actual working time amounting to 85·5 per cent. of the working time for this phase, which averaged 14·8 mins. per cu. m. of merchantable wood. The mean values for time spent on individual operations, in percentage of working time, were: axe work 36·7, sawing 36·8, wedging 2·5, freeing lodged trees 9·5, breaks 3·0, intervals 11·5. Though felling time per tree increased with increasing diameter, the opposite was true of felling time per cu. m. It was also concluded that, below 13 cm. diameter, felling by saw is wasteful of time.

(ii) *Trimming* averaged 5·9 per cent. of the working time for all phases. Of the time for this phase alone, averaging 5·5 mins. per cu. m. of merchantable material, 97·1 per cent. was actual working time, breaks and intervals making up only 1·3 and 1·6 per cent. respectively. There was no significant difference between young and old woods in percentage of time spent on trimming, but expressed as time per cu. m. of merchantable material, trimming times showed a marked decrease with increasing diameter.

(iii) *Cross-cutting* took an average of 46·7 per cent. of working time for all phases. Of the working time for this phase, averaging 43·7 mins. per cu. m. of merchantable material, 93·2 per cent. was actual work (consisting of marking off log lengths 1·6 per cent., sawing 79·8 per cent., propping up logs for sawing 11·1 per cent., and miscellaneous jobs 0·7 per cent.), 2·1 per cent. breaks, and 4·7 per cent. intervals. As with trimming, the percentage time for cross-cutting was similar in both old and young woods, but in older woods less time was spent per cu. m. of produce.

(iv) *Cleaving* averaged 5·6 per cent. of total working time and 5·3 mins. per cu. m. of merchantable material. Of the working time for this phase, 96 per cent. was actual working time, 2·9 per cent. breaks, and 1·1 per cent. intervals. The figures for the phase, however, were extremely variable,

mostly because of variation in the proportion of cleft material produced in the different areas. There was, in fact, good correlation between the percentage of cleft material and cleaving times.

(v) *Assembly and stacking* amounted to an average of 25 per cent. of total working time, or 23 mins. per cu. m., 95·9 per cent. of which was actual working time, 2·2 per cent. breaks, and 1·9 per cent. intervals. Of the working time for this phase, removal of cut products from the wood took 48·4 per cent., assembly and stacking 35·0 per cent., and driving posts for stacks 12·5 per cent. The latter figures, however, are much affected by the particular methods of removal used (by hand, wheels, or sledge), distance travelled and percentage of stem logs (as these were left in the woods). In a special investigation of the time taken to build stacks of 1 and 2 stacked cu. m. respectively, the double stack was not found to be time-saving compared with the single one, except for a very slight economy in the time spent in driving posts.

In conclusion it is emphasized that as the study was carried out on sample operations varying simultaneously in many respects, its chief value is to direct attention to the nature of, and difficulties involved in, such studies, and to indicate very broadly the relative importance and order of magnitude of the timings for the different phases. As such, it is a preliminary to further detailed studies, of which some (such as the testing of tools) might well be performed in the laboratory, but most would necessarily take place in the field, where the great difficulty is to standardize all factors other than the one whose influence is to be investigated. It would be an advantage if further studies could be supplemented by physiological work also.

P. G. B.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

01. DEFINITIONS. NOMENCLATURE. CLASSIFICATIONS

01.2. (68). **A standard nomenclature for South African grown timbers.** *J. S. Afr. For. Ass.* No. 12, 1944 (60–70). [E.Afr.]. [510].

This final standard nomenclature of 167 South African tree names has been adopted by the Main Committee of the South African Standards Institution. Copies are obtainable at the Central News Agency, Eloff St., Johannesburg and British Standards Institution, 28 Victoria St., London: S.A.S.I.'s Specification No. 21, 1943, price 2*s*. The list gives standard name, other names, botanical name, natural habitat and weight per cu. ft.

01.2 (73). HARLOW, W. M. **Some comments on the new Check List and other things nomenclatural.** *J. For.* 43, 1945 (403–6). [New York State College of Forestry, Syracuse, N.Y.] [511].

A proposed revision of the U.S. Forest Service Check List of the native and naturalized trees of the United States is the occasion of this article on problems of plant nomenclature. The author believes that strict adherence to the international rules at times promotes, rather than avoids, confusion, and he urges the retention of scientific names that have long been in general use, such as *Acer saccharum*, *Sequoia gigantea*, and *Abies nobilis*.

01.2 : 12.25–8 (73). LITTLE, E. L. **Miscellaneous notes on nomenclature of United States trees.** *Amer. Midl. Nat.* 33, 1945 (495–513). [U.S. Forest Service, Washington, D.C.] [512].

In this article are four new combinations in *Cereus*, *Rhamnus* and *Salix*, and a few miscellaneous notes on *Quercus*, *Ilex*, and *Rhus*. Names published in rare or seldom consulted publications of Trew, Duhamel, Linnaeus, Bartram, Audubon, and Torrey are discussed. There are also notes on *nomina subnuda*, the gender of generic names, the original spelling of scientific names, and on names by other authors published by Linnaeus. *From author's introduction.*

05. PERIODICALS

05.3. *Annual Reports*

05.3 (54.2). UNITED PROVINCES. **Annual progress report of forest administration in the United Provinces for the year 1943–44.** Typescript. [1944?] pp. 26. [513].

05.3 (54.87). CEYLON. **Administration report of the Conservator of Forests for 1943.** Ceylon Govt. Press, Colombo. 1945. pp. 7. [514].

05.3 (67.8). TANGANYIKA. **Twenty-third annual report of the Forest Department, Tanganyika Territory, for the year ended 31st December, 1943.** Govt. Printer, Dar es Salaam. 1944. pp. 12. [515].

05.3 (71.11). ALBERTA. **Annual report of the Department of Lands and Mines of the Province of Alberta for the fiscal year ended March 31st, 1943.** King's Printer, Edmonton. 1944. pp. 112. [516].

05.3 (71.21). MANITOBA. **Annual report, 1943–44: Forest Service, Department of Mines and Natural Resources.** Department of Mines and Natural Resources, Manitoba. [1944?] pp. 40. [517].

05.3 (71.4). NEW BRUNSWICK. **108th annual report of the Department of Lands and Mines of the Province of New Brunswick for the year ended 31st October, 1944.** Fredericton, N.B. 1945. pp. 125. [518].

05.3 (71.6). NOVA SCOTIA. **Report of the Department of Lands and Forests, 1944.** King's Printer, Halifax, N.S. 1945. pp. 181 + plates + tbls. [519].

05.3 (729.7). TRINIDAD. **The Imperial College of Tropical Agriculture: report of the Governing Body and the Principal's report**

to December 31st, 1944, and the accounts for the year ended August 31st, 1944. St. Augustine, Trinidad. London Office: Grand Buildings, Trafalgar Square, W.C.2. 1945. pp. 27. [520].

05.3 (73). UNITED STATES. **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 1943.** United States Department of Agriculture, Washington, D.C. 1944. pp. 58. [521].

05.3 (73). UNITED STATES. **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 1944.** United States Department of Agriculture, Washington, D.C. 1945. pp. 56. [522].

05.3 (94). AUSTRALIA. **Eighteenth annual report of the Council for Scientific and Industrial Research for the year ended 30th June, 1944.** Govt. Printer, Canberra. 1944. pp. 78. [523].

05.3 (942). SOUTH AUSTRALIA. **Annual report of the Woods and Forests Department for the year 1942–43.** Govt. Printer, Adelaide. 1944. pp. 11. [524].

06. CONFERENCES

06.2 (54) : 07.1–2 : 8 : 11.62 : 34. INDIA. **Proceedings of the meeting of the Board of Forestry held at the Forest Research Institute, Dehra Dun, 31st Oct. to 3rd Nov. 1942.** Govt. of India Press, New Delhi. 1944. pp. 127 + map. [525].

This meeting of the Indian Board of Forestry, which was attended for the first time by Ministers in charge of forests, was devoted largely to the general policy for research and education and forest administration under wartime conditions. Recommendations made at this meeting were concerned with:—(*a*) Increasing the utility of the Research Institute to the Provinces. (*b*) Provision of staff at the Institute and Colleges, particularly to meet increased educational demands. (*c*) Erosion and grazing control, for which the urgent needs are (i) administrative machinery for grazing control based on the collection and application of local data on incidence, and extension of propaganda to pasture users, and (ii) the appointment of a central staff to define the problem of erosion and floods by regions or river basins, with the intention ultimately of creating an all-India Soil Conservation Service and probably a complete special Soil Conservation Department in each Province to advise Government on general land policy and to carry out erosion control and land management. (*d*) The grading and cleaning of minor forest products with measures to guarantee purity, which depend on co-ordinating the growth and production of the raw material with the actual industrial production and the appointment of regional and central staff for the purpose. (*e*) The provision of a sinking fund out of excess profits to provide the expenditure on forest reconstruction needed after the war. (*f*) Revision of the rules for the Indian Forest College and the Indian Forest Rangers' College, one of the innovations being a proposal to style a holder of the Diploma 'Associate of the Indian Forest College'. (*g*) Post-war control for (i) the release of surplus Defence Department stocks, (ii) stabilization of sleeper prices, and (iii) replacement of lost forest capital by revision of working plans to reassess yield on a conservative basis and to secure a planned flexible economy for the timber trade and the development of India's forest estate.

The Report also contains a reprint of 'Fodder trees in India' (pp. 28–38), and of *Indian For. Leafl.* No. 27, 'Notes on some aspects of erosion control' (pp. 38–50), and a note on 'Recent attempts to check soil erosion in the Punjab' by H. M. Glover (pp. 126, 127).

07. EDUCATION AND RESEARCH. COLLECTIONS. EXPERIMENTAL FORESTS

07.1 (42.1–9) : 60.31.2. ACKERS, C. P. **Post-war forestry training centres.** *Quart. J. For.* 39, 1945 (99–103). [526].

The problems relating to the supply of trained foresters for private forestry in Great Britain after the war are discussed with reference to (1) work of immediate importance, (2) number and type of men required, and (3) method of training. It is concluded that at least 250 men a year are needed for the first four years, to be trained by the end of the fifth year. The writer suggests that the men should first be placed on private estates to get practical experience and later be sent to local training centres; those selected for advanced training would go on to university courses.

07.5 (74.7). **Catalog of hardy trees and shrubs: a list of the woody plants in cultivation outdoors at the New York Botanical Garden in 1942.** New York Botanical Garden, Bronx Park, New York, N.Y. 1943. pp. vii + 127 + plates + map. Price 75 cents. [527].

The main list is arranged alphabetically under genera, with lists of species under each genus. Notes are given on the time of flowering of each species and on the general characteristics of the genera listed.

07.6 (494) : 64–5 : 56. KNUCHEL, H. Das Lehrrevier der Abteilung für Forstwirtschaft an der Eidg. Technischen Hochschule. **[The instructional forest of the Forestry Department of the Swiss Federal Technical College.]** *Schweiz. Z. Forstw.* 92, 1941 (169–88, 212–25). [G.] [528].

An account of the 167·40 ha. instructional forest of the Eidgenossiche Technische Hochschule, which lies at the foot of the northern slope of the Uetliberg beside the Zürich-Selnau railway. In 12 years the growing stock has increased from 42,331 to 51,900 sv.,* and the average stem volume has risen from 0·80 sv. in 1926 to 0·94 sv. in 1938. The author discusses the site and silvicultural condition of the forest and gives data on increment, utilization, and the cutting budget.

07.6 (729.5) : 23.2 : 12.26–8. WADSWORTH, F. H. **The first year in the Cambalache Experimental Forest.** *Carib. For.* 6, 1944 (34–44). [E.Span.f.] [Tropical Forest Exp. Sta., Puerto Rico.] [529].

The Cambalache Experimental Forest, consisting of 616 acres, has been made available for research purposes to the Tropical Forest Experiment Station, Puerto Rico. An account is given of the protective measures necessary and of the research carried out in the first year, which was mainly concerned with regeneration. Of outstanding importance in such a dry climate is the need for small local tree nurseries for forest plantings so that immediate advantage may be taken of rains. Successful trial plantings were made of *Piptadenia peregrina*, *Swietenia mahagoni*, *Neltuma* [*Prosopis*] *juliflora*, *N.* [*P.*] *chilensis*, which all proved very drought-resistant. Direct seeding appears to be a more practical method for establishing *Stahlia monosperma* and is also promising for *Swietenia mahagoni*. *Bucida buceras*, one of the most valuable species in the forest, has been found difficult to propagate because of the very low seed viability. Better seed has now been located and further experimental sowings made. *Guaiacum officinale* failed when sown directly under partial shade, possibly owing to the perishability of seed during the drought. Further trials will be made in better weather.

*The sv. (*silve*, *sylve*) is the conventional unit of *standing* volume (approximately a cu. m.) in the 'tariffs' or 'management volume tables' used under Biolley's 'méthode du contrôle'. The tables are local, empirical, and based on diameter alone or diameter with very broad height classes.

09.1. *Forest History*

09.1 (43.7). KIRWALD, E. Grundzüge einer Sudetendeutschen Forstgeschichte. **[Outlines of Sudeten-German forest history.]** *Forstwiss. Cbl.* 63, 1941 (121–39, 156–60, 179–85). [G.] [530].

A review of developments in Sudeten forestry under five main headings: (1) general historical survey; (2) forest history up to the end of the Middle Ages; (3) up to the Theresian forest regulations (1754); (4) from 1754 to 1918; and (5) the period of protection (1918–38).

09.2. *Pre-history*

09.2 (4) : 91. CLARK, G. **Farmers and forests of Neolithic Europe.** *Antiquity* 19, 1945 (57–71). O.G. [531].

The theory has long been widely held that Neolithic man was capable of colonizing only 'open' country, and necessarily avoided forest areas. The aim of this article is to show that the theory rests on false premises, and that, so far from being hostile, forest played a vital part in the spread of farming in Northern Europe. The technique of pollen analysis has done much to afford a solid basis of fact and shows that, to a great extent, the spread of Neolithic culture coincided with the greatest extension of the forest. The location of prehistoric settlements points the same way. The writer believes that the greater fertility and ease of working of forest soils led Neolithic man actually to choose them. There is some positive evidence, e.g. from the peat bog at Ordrup in Denmark [cf. *For. Abstr.* 6 (5)], that the forest was cleared by burning, and no doubt stumps were left to decay in the ground and cultivation carried on around them. There is also no doubt that it was possible to fell trees

with chipped or polished stone axes. Neolithic dwellings, tombs and canoes needed a great deal of timber, and the number of large axes which are found show the extent of their use. Experiments made in recent times have proved that an Oak of 8 in. diameter can be cut down with a polished flint axe; a Fir tree 17 cm. in diameter can be felled in 7 minutes using an axehead of chipped flint, and in 5 minutes using one of polished stone. Another factor in deforestation was no doubt the grazing of domesticated animals.

Until, at the very close of the prehistoric age, the farmer possessed a heavy-wheeled plough, he was unable to tackle the heavier, poorly drained soils. The contrast between the areas settled by prehistoric man and those shunned by him was not as between forested and 'open' lands or even as between those 'densely' and 'lightly' forested, so much as between soils which he could and those which he could not cultivate.

09.2 (47.2–6 : 57) : 12.19. BLAGOVESHCHENSKI, G. A. Istoriya lesov votochnogo sklona srednego Urala. **[History of the forests on he eastern slope of the central Ural.]** *Sovetsk. Bot.* No. 6, 1943 (3–16). [Russ.russ.] O.B.D. [532].

The micropalaeobotanical research reported in this paper, on lake deposits and peat bogs on the Eastern slope of the Middle Ural, including the results of pollen analyses, demonstrates percentage correlation of different ecological diatom groups and compares the Middle Ural and adjacent Cis- and Trans-Ural regions.

The post-glacial period of the Urals and Trans-Ural had several phases, the most ancient of which is indicated by high lake terraces in Trans-Ural. The following phase was one of maximum dryness indicated by the diatoms of subsaline lakes and by saline soil underlying peat bogs. During these two periods, it is probable that Birch was predominant in Trans-Ural and Pine in Ural. During the third phase, characterized by a moister climate, organic deposits rich in pollen were formed in the Ural lakes, and Birch forests were predominant in the Ural, Birch forest-steppe in the Trans-Ural watersheds, Pine in river valleys, and coniferous forests without bogs in Vasuganie. In the last phase, which was similar to the present age, Pine forests extended in the Urals and bogs began to form in catchments in Vasuganie. Spruce taiga was predominant in Cis-Ural throughout the post-glacial period.

The Middle-Ural and Trans-Ural forests of the post-glacial period were characterized by fluctuations of Pine and Birch, which are the predominant species in forest formations of those regions to-day, whereas in the forests of the European part of the U.S.S.R. there were different types resulting from the extensive spreading of Spruce, Oak, Lime, Elm, and Hazel.

During the whole of the post-glacial period the ridge of the Ural mountains formed a boundary between the two climatic regions,—dry on the Eastern side and moist on the Western side. Spruce and Silver Fir forests spread in the West, and Birch/Pine in the East. Apart from the dry climate of the Trans-Ural, the saline soil was another constant obstacle to the penetration of all species except Birch. During the post-glacial period, Oak was an essential feature in the forest formation of the European part of U.S.S.R., but, according to micropalaeobotanical evidence, it did not reach even the western slope of the Urals because of climatic conditions and the presence of umbrageous Spruce forests that had existed there since the glacial period.

09.2 (52) : 12.25. SHIMAKURA, M. **On the occurrence of *Taxodioxylon albertense* (Penhallow) in the Senonian of Karahuto (Japanese Saghalien).** *J. geol. Soc. Japan* 47, 1940 (45–8). [Jap.e.] *Abstr.* in *Jap. J. Geol. Geogr.* 18 (3), 1941 (31). O.G. [533].

09.2 (52) : 12.25 : 12.19. SHIMAKURA, M. **The past distribution and origin of coniferous plants in Japan.** *Abstr.* in *Jap. J. Geol. Geogr.* 18 (3), 1941 (29–30). [E.] O.G. [534].

The earliest occurrence of a coniferous plant hitherto recorded is the Dictyoconites bed of the Kitakami Mountains; this is a *Dadoxylon*-type wood showing well marked growth rings. In the Triassic and Jurassic flora there are several genera related to the Coniferae, i.e. *Pitophyllum*, *Podozamites*, *Elatocladus*, *Brachyphyllum*, *Araucarites* and *Dadoxylon*; some species of the two last-named genera closely resemble *Araucaria* and *Agathis* now living in South America and Australia.

Coniferous plants are common in the Lower Cretacean, the chief elements being *Podozamites*, *Frenelopsis*, *Elatocladus*, *Cyparissidium* and *Araucarites*. The younger Cretaceous

conifers are of special interest for tracing the ancestors of living genera; amongst these are *Planoxylon*, *Brachyphyllum*, *Piceophyllum*, *Geinitzia*, *Paracupressinoxylon*, *Protophyllocladus* and *Phyllocladoxylon*. The presence of *Araucaria*, *Sciadopitys*, *Sequoia*, *Cunninghamia*, *Cedrus*, and *Libocedrus* in the Upper Cretacean in Japan accounts for the special distribution of present conifers.

Plants closely resembling *Abies*, *Tsuga*, *Larix*, *Picea*, *Pseudotsuga*, *Pinus*, *Sciadopitys*, *Sequoia*, *Taxodium*, *Glyptostrobus*, *Cryptomeria*, *Thuja*, *Thujopsis*, and *Juniperus* have been found in the Tertiary flora of Japan. The genus *Taxodium*, now found wild only in North America, was a forest tree of Japan in the early part of the Tertiary period. The genus *Sequoia*, now confined in the Pacific slope of North America, was distributed over the Northern Hemisphere in the Tertiary period and was still living in Japan in the Pliocene stage. *Glyptostrobus*, another genus which was widely distributed in the Tertiary period, is now confined to Central China.

Pleistocene vegetation shows many coniferous species identical with living ones, e.g. *Taxus cuspidata*, *Torreya nucifera*, *Cephalotaxus drupacea*, *Abies firma*, *Tsuga sieboldii*, *Larix kaempferi*, *Picea polita*, *Pinus densiflora*, *Cryptomeria japonica*, *Thuja japonica*, *Chamaecyparis obtusa*, and *C. pisifera*.

09.2 (52) : 12.26–8. ENDÔ, S. **Some new and interesting Miocene plants from Tyôsen (Korea).** *Jap. J. Geol. Geogr.* 18 (3), 1941 (30–1). [E.] O.G. [535].

The writer made a large collection of fossil plants in Korean coal mines, comprising 93 species in 51 genera and 31 families. Most of the plants are Dicotyledons; Coniferae are represented by only 5 species, and Monocotyledons and Filicates are very rare. Species included in this collection which are still living in the Japanese islands are *Carpinus japonica*, *Fagus japonica*, *F. crenata*, *Hamamelis japonica*, *Cercidiphyllum japonicum*, *Fagus multinervis*. The following species are described:—*Glyptostrobus europaeus*, *Sequoia japonica*, *Fagus multinervis*, *F. crenata*, *F. japonica*, *Engelhardtia koreanica*, *Comptoniphyllum naumanni*, *Carpinus cordata*, *C. japonica*, *Liriodendron meisenense* (n.sp.), *Cercidiphyllum japonicum*, and *Porana kokangenensis* (n.sp.).

09.2 (52) : 12.26–8. ENDÔ, S. **A Pleistocene flora from Shiobara, Japan.** *Sci. Rep. Tôhoku imp. Univ. 2nd Ser. (Geol.)* 21, 1940 (47–80) [E.] *Abstr.* in *Jap. J. Geol. Geogr.* 18 (3), 1941 (31–2). O.G. [536].

The Pleistocene plants from Shiobara described in this paper include species of the following genera:—*Juglans*, *Alnus*, *Betula*, *Carpinus*, *Castanea*, *Fagus*, *Quercus*, *Celtis*, *Ulmus*, *Trochodendron*, *Cercidiphyllum*, *Magnolia*, *Hydrangea*, *Schizophragma*, *Hamamelis*, *Amelanchier*, *Micromeles*, *Sorbus*, *Prunus*, *Ilex*, *Berchemia*, *Vitis*, *Tilia*, *Stewartia*, *Myriophyllum*, *Kalopanax*, *Cornus*, *Cynoxylon*, *Clethra*, *Rhododendron*, *Meisteria*, *Tripetaleia*, *Xolisma*, *Palura*, *Symplocos*, *Styrax*, *Fraxinus*, *Viburnum*.

09.2 (79.7) : 12.25–8. BECK, G. F. **Ancient forest trees of the sagebrush area in Central Washington.** *J. For.* 43, 1945 (334–8). [Central Washington College of Education, Ellensburg, Wash.] [537].

The petrified trees of the Russell forests in central Washington are of unusual interest because of the great diversity of species represented. This article gives information on the local distribution and abundance of 37 woods, with brief descriptions of some of their chief characteristics.

09.4. *Forest Statistics*

09.4 (43.7) : 98.1 : 98.3. **Czechoslovakia's resources.** *Timb. Tr. J.* 173, 1945 (337–8). [538].

The forest area of Czechoslovakia before the Munich agreement of 1938 amounted to over 4½ million ha. and the annual increment of round timber was between 17 and 18 million cu. m. During the depression of the early 1930's the annual cut was reduced by one-third, so that by 1938 reserves had reached something like 30 to 36 million cu. m. However, the forests were heavily overcut during the German occupation, fellings in some areas amounting to 350 per cent. of annual increment, and it is believed that Czechoslovakia will not now be able to find enough wood to satisfy her own needs. Before 1938 there were 1,140 sawmills in the country, and domestic consumption of round timber was estimated as follows (in cu. m.): paper and cellulose 1,906,400; pitprops 716,000; telegraph poles 30,000; sleepers 215,000; timber for State railways 275,000; match factories 3,000 (of Poplar); timber industry, including sawmills, 6,264,000.

09.4 (71) : 98.1. CANADA. **Estimate of forest production: operations in the woods in Canada, 1943.** Dominion Bureau of Statistics, Ottawa. 1945. pp. 10. [E.F.] [539].

The estimated or reported total production of each of the principal wood products is tabulated, together with its equivalent in volume of standing timber and its value. Forest production in terms of standing timber and value is recorded for each province, and figures are given for the value of each of the principal forest products for 1943 and each of the preceding four years. The total forest production in 1943 is estimated at over 3,079 million cu. ft. of standing timber with a value of more than $268 million.

09.4 (74.8). WIRT, G. H. **Area of forest in Pennsylvania.** *For. Leaves* 35 (1), 1945 (1–2, 9–10). [540].

A review of the forest area of Pennsylvania at different periods, based on data from various sources including census figures, foresters' reports, forest maps and aerial photographs. The latest figures obtained from air photographs taken in 1940 indicate that the present area of forest land in the State is about 15,127,640 acres.

09.4 (83) : 09.7 : 98.1–2 : 32. HAIG, I. T. **Forests and forest industries in Chile.** *Carib. For.* 6, 1945 (191–207). [E.Span.f.] [Appalachian Forest Exp. Sta., U.S. Forest Service.] [541].

The forests of Chile, including natural woodland and plantation, cover about one-fifth of the Republic's land surface or some 16 million ha. Commercial high forests amount to 5½ million ha., of which more than one million ha. is in second-growth stands, cut-over areas or deforested burns. This forest (over 90 per cent. hardwoods) consists of typically Chilean trees including Coigüe (*Nothofagus dombeyi*), Raulé (*N. procera*), Roble (*N. obliqua*), Tepa (*Laurelia serrata*), Laurel (*L. aromatica*), Olivillo (*Aextoxicon punctatum*), Ulmo (*Eucryphia cordifolia*), Lingue (*Persea lingue*), with fine but limited coniferous forests, chiefly of Araucaria (*Araucaria araucana*), Alerce (*Fitzroya cupressoides*) and Ciprés (*Libocedrus* sp.). The trees range in height from 25 to 35 m. and commonly up to 100 cm. or more in diameter. The bulk of the merchantable timber is usually found in 2 to 5 species, Coigüe and Tepa making up over half the saw-timber volume in merchantable stands. Net volume in virgin saw-timber stands averages about 37,000 bd. ft. per ha., with stands north of Puerto Monte averaging 53,000 bd. ft. The total is estimated at about 104 billion bd. ft.

In addition to the high forest, Chile has a large area of woodland intensively cut over for fuel and farm use, and a small but important plantation area consisting chiefly of *Eucalyptus globulus* or *Pinus radiata*. Alamo (*Populus nigra* var. *italica*) is also grown for match stock, farm use and rough lumber.

This forest resource now supports a small but varied forest industry. There are some 600 to 700 sawmills in Chile, most of them cutting not more than 5,000 bd. ft. per day. Forest industries and industries dependent on forest products for their basic raw materials represent an investment of over one million pesos and employ some 44,000 workers exclusive of those cutting fuelwood. Chile now consumes, largely in home markets, about 300 million bd. ft. plus 158 million cu. ft. annually. Depletion of the forest by cutting represents less than 15 per cent. of the total depletion in cu. ft. of material taken from live standing trees, the remainder being lost through fire, windfall, insects and disease. Fire is the most destructive agency, owing to lack of organized fire protection. Annual loss of timber killed by fire has recently averaged 682 million cu. ft., equivalent to slightly more than one per cent. of Chile's total stand or four times the saw-timber drain by cutting.

The article also gives some account of the rather primitive logging and sawmilling methods, and of some of the forest industries. To sustain these on a permanent basis Chile must develop and execute a forest policy of broad scope.

09.7. *Monographs of Individual Forest Regions*

09.7 (46) : 12.25–8 : 12.19. MARTÍNEZ, C. V. Materiales para el estudio de la flora soriana. **[Material for the study of the flora of the Province of Soria.]** *An. Jard. bot. Madrid* 2, 1941 (188–235). [Span.] K. [542].

The material presented in this work was collected for the purpose of making a forest map of the Province of Soria. It includes notes on the distribution and habitat of many tree species, including representatives of the following genera: *Taxus*, *Pinus*, *Juniperus*,

Populus, Salix, Corylus, Betula, Fagus, Quercus, Ulmus, Sorbus, Crataegus, Buxus, Ilex and *Fraxinus*. The twig and leaf of *Quercus numantina* Ceb. et Vic. (*Q. lusitanica* v. *valentina* × *pyrenaica*) are illustrated by drawings.

09.7 (67.5) : 98.1 : 11.62.1 : 23.3. THOMAS, R. Les forêts et l'exploitation forestière au Congo: le deboisement, l'érosion et le reboisement. [**Forests and forest exploitation in the Congo: deforestation, erosion and reforestation.**] *Bull. agric. Congo belge* 32, 1941 (91–111). [F.] [543].

From 48 to 53·5 per cent. (1,116,000 to 1,255,00 sq. km.) of the Belgian Congo is wooded. The smaller of these figures includes 1,013,000 sq. km. of tropical forest, 8,000 sq. km. of outlying and transitional types and 95,000 sq. km. of wooded savanna. The representation and composition of the tropical types are very complex and there are no pure stands except of *Macrolobium dewevrei*, and few dominant species save *Macrolobium* and *Cynometra* in some places. The greater part of the tropical forest is administered by the State, but some 9 million ha. of wooded savanna are exploited by the Comité Spécial du Katanga and about 10½ million ha. by the Comité National du Kivu. Total production in 1937 by State, C.S.K. and C.N. Ki. (excluding wood felled by natives for their own use) was as follows:—Firewood, 4–5 million cu. m.; constructional timber, 160,000 cu. m.; poles, posts and mining timber, 15,000 cu. m. There are no figures available for exports except for wood in the round, which in 1937 amounted to 86,666 metric tons.

Deforestation has already led to serious erosion and soil deterioration in large areas of the Colony, particularly in those regions which were originally least heavily forested. The principal causes are fire, shifting native cultivation and over-grazing. In several districts the need of reforestation is urgent, for the provision of firewood is becoming increasingly difficult, and plantations have been started by various Government agencies. By 1937 these amounted to about 3,000 ha. Apart from native species, those planted include various species of *Eucalyptus, Chlorophora excelsa, Terminalia superba, Tectona grandis, Maesopsis eminii, Cassia siamea, Cupressus* spp. *Acacia decurrens, Juniperus procera, Grevillea robusta.*

09.7 (71.21) : 98.1 : 09.4. HASTINGS, W. B. **The natural resources of Saskatchewan.** Department of Natural Resources and Industrial Development, Province of Saskatchewan. 1945. pp. 113 + map. [544].

Although Saskatchewan is known as a prairie province, probably one half of its entire area of 251,700 sq. miles is more or less forested. The White Spruce (*Picea canadensis*) is the only species that can be classed among the leading commercial timbers of the world; it is widely distributed, fairly plentiful, and grows well in these districts. Other species suitable for the manufacture of lumber are Black Spruce (*Picea mariana*), Jack Pine (*Pinus banksiana*), Balsam Poplar (*Populus tacamahaca*), and Tamarack (*Larix laricina*). A great part of the forested area is unimportant for timber production, owing to its inaccessibility, poor quality of timber, and high proportion of rock and muskeg. The area that may be considered as containing commercial forests is bounded on the north by the Churchill River and extends south of the Saskatchewan, while to the west it barely reaches as far south as that river. This belt, about 55,000 sq. miles, contains all the timber that is exploitable at present, and even of this area only about one-half carries merchantable, accessible timber. Various estimates have been made of the amount of timber available, and there is some agreement on a stand of saw timber (over 10 in. d.b.h.) of, in round figures, 6,055 million bd. ft. Some 4,680 million bd. ft. are at present accessible, and of this Spruce and Jack Pine, the only two species yet regularly accepted in the industry, constitute about 2,560 million bd. ft. The accessible Poplar stand is 2,080 million bd. ft., for which there is as yet very little demand. The remaining accessible timber of merchantable size includes 20 million bd. ft. each of Balsam Fir and White Birch [*Betula papyrifera*]. The present estimate for the total stand of small material (4–10 in. d.b.h.) is 67,075,000 cords, of which 60,478,000 cords may be considered as reasonably accessible, made up as follows: Spruce 6,650,000 cords, Jack Pine 2,270,000 cords, Poplar 50,000,000 cords, White Birch 1,000,000 cords, Balsam Fir 300,000 cords, Elm 25,000 cords, Maple 18,000 cords, and Ash 15,000 cords. The total market value of forest products in 1942–43 was $4,948,729, and there were 323 sawmills operating.

The province may look forward to a time within the next decade when practically all its accessible coniferous saw timber will have been cut, all its old virgin Spruce stands harvested, and the annual Spruce lumber production very materially reduced. The present trend, however, appears to be towards greater utilization of smaller sizes and second-growth trees for pulp, paper, cellulose products, etc.; the extension of such industries will no doubt reduce much of the present waste of wood and create new markets for smaller dimensions and species at present unused.

The total area of Provincial Forests is 14,061 sq. miles.

09.7 (728.6) : 46 : 32 : 33.36.3. Los bosques de Costa Rica. II.—Explotación de los bosques. **[The forests of Costa Rica. II.—Exploitation of the forests.]** *Rev. Agric, S. José* 17, 1945 (166–7, 169–71). [Span.] A.P.B. [545].

The greater part of Costa Rica consists of either virgin forest or cultivated land. In general, no attempt has been made at organized forest management, and little attention has been paid to the marketing of the timber, with the exception of few 'precious' woods such as Caoba (*Swietenia* sp.) and Cedro Amargo (*Cedrela* sp.) for export, and certain other species for local consumption. The practice of removing from the forest only those trees for which there is a good market has led to a scarcity of seed trees of these species in certain districts and progressive deterioration in the composition of the remaining forest. Shifting cultivation has also affected the forests of Costa Rica. Forest fires have never been an important influence, since the climate is generally too humid for large-scale fires to occur. Planting has been carried out only on a very small scale, mainly with exotics such as *Casuarina* and *Grevillea* for windbreaks.

Brief sections are included on logging, transport, sawing and seasoning of timber in Costa Rica and on timber prices.

09.7 (729.5) : 98.1. Wadsworth, F. H., and Gilormini, J. A. **The potentialities of forestry on Mona Island.** *Carib. For.* 6, 1945 (219–44). [E.Span.f.] [Tropical Forest Exp. Sta., Puerto Rico.] [546].

This report gives a detailed account of the small island of Mona situated between Puerto Rico and the Dominican Republic, especially of its forests and their potentialities. It is concluded that forest products will never be available in quantity and that their production will be a minor enterprise compared with fishing, agriculture and recreation, if these latter are developed to the greatest extent possible.

09.7 (86) : 12.19.2 : 98.1–2. Horn, E. F. **Forest resources and forest types of the Province of El Oro, Ecuador.** *Carib. For.* 6, 1945 (209–18). [E.Span.f.] [547].

An account is given of the topography, geology, soils, climate, and means of transport in the Province of El Oro in the south-west corner of Ecuador, followed by a description of the forest types. A belt of Mangrove swamp fringes the coast, and the rest of the coastal plain is occupied by a xerophytic forest or scrub, the principal tree species being *Acacia* and stunted *Ceiba*. Further inland the Ceiba trees are larger with characteristic swollen trunks and associated with them are Guayacán (*Tabebuia chrysantha*), Cascól (*Libidibia corymbosa*), Ébano (*Zizyphus thyrsiflora*), and Coquito (*Erythroxylum glaucum*), all yielding, hard dense woods. In the lower foothills of the Andes there is a transition type between the xerophytic forest of the coastal plain and the wet forest of the Andes foothills proper. The evergreen wet forest is not so luxuriant as the lowland forest further north. The trees are slender and of medium height, forming a very light somewhat open forest. The principal tree species are Palma Real (*Cocos butyracea*), Pambil (*Euterpe chaunostachys*), Fernan Sanchez (*Triplaris guayaquilensis*), Matapalos (*Ficus* sp.). Other important species occurring in this type are Palo de Vaca (*Alseis eggersii*), Palo de Rosa (*Aspidospermum polyneuron*), Cauje (*Pouteria caimito*), Balsamo (*Myroxylon balsamum*), Ajo (*Gallesia* sp.), Moral Fino (*Chlorophora tinctoria*), Balsa (*Ochroma lagopus*), Moral Bobo (*Sideroxylon*), Cedro (*Cedrela* sp.) and Balsa Blanca (*Heliocarpus popayanensis*).

The forest resources of this province have not been greatly developed except locally. The only forest products exported are Balsa lumber, Guayacán and Coquito sleepers and Mangrove bark. Red Mangrove (*Rhizophora mangle*) is one of the chief construction timbers of Western Ecuador owing to its durability. The bark, which is rich in tannic acid, is removed and shipped to the tanneries near Guayaquil. There are two small sawmills

which produce Balsa lumber for export. The mining industry is the largest consumer of timber in the province and the complete utilization of these forests will largely depend upon the further development of the mineral resources of the Province.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.14. Precipitations. Evaporation. Humidity

11.14 : 91.3. Luchshev, A. A. Isparenie i isparyaemost' v lesu i v pole. [**Evaporation in forest and in field.**] *Trud. vsesoyuz. nauchno - issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (269–78). [Russ.] [548].

Observations on evaporation were made at Istrinsk in a Spruce plantation, a meadow and a fallow field between 20th February and 4th April. The mean daily rate of evaporation as measured by a Rykachev evaporimeter was 0·44 mm. in the field, and 0·1 mm. in the Spruce stand; about the end of March daily evaporation of the snow layer reached 1·5 mm. in the field and 0·5 mm. in the forest, and snow evaporated on the whole 5 times slower in forest than in field. Records with a Wild evaporimeter indicated evaporation in the field to be 3 times as great as in the forest. Snow was recorded to evaporate 15 per cent. quicker than ice. Night evaporation in the forest was 3·5 times less than during the day. Variation in evaporation in forest or field is largely governed by the amount of soil moisture; during summer the total monthly evaporation in the forest did not exceed 12 mm. whereas in the field it reached 69 mm. and in the meadow 88 mm. In June and July evaporation of the surface soil of the field exceeded the precipitation and in August it decreased to 15 mm. owing to soil dryness, whereas in the forest the soil was still moist and there was very little falling off in the total monthly evaporation. In September and October the low percentage of evaporation is due to low air temperature and high humidity rather than to soil dryness. During the dry months evaporation in the meadow exceeded that in the field and both gave figures for evaporation higher than the total precipitation of the growing season.

11.14.3 : 07.7. Wicht, C. L. **Improvements in the gauging of rainfall.** *J. S. Afr. For. Ass.* No. 12, 1944 (19–28 + plate). [549].

A review of the methods used for gauging rainfall indicates that improvements are required to reduce or exclude certain systematic errors. It is proposed that random sampling should replace established methods. To reduce the number of gauges required to estimate variability of rainfall over a sample area, a method of circulating gauges over a large number of fixed positions is suggested. The shielding of gauges from the wind is considered essential and a Nipher-type shield is advised. The need of erecting gauges perpendicular to slopes is stressed. Fourcade gauges for estimating direction and inclination of rain and to measure horizontal misty rain are described. The efficacy of liquid paraffin to prevent evaporation from monthly-read gauges is experimentally proved. Casual errors have only slight effect on readings of standard 5-inch gauges. *From author's summary.*

1/1.14.6 : 11.14.3 : 12.25 : 12.26–8 : 07.7. Millett, M. R. O. **Evaporation and rainfall inside and outside a forest.** *Leafl. Commonw. For. Bur. Aust.* No. 57, 1944. pp. 16. [550].

Evaporation: Daily evaporation measurements from a free water surface were made for a period of twelve months inside and outside three forest sites in the Australian Capital Territory.

Monthly and yearly data are given. Two different plantations of Monterey Pine had an inside evaporation of 28·5 per cent. and 33·1 per cent. respectively of the evaporation in the open outside the plantation. The open Eucalypt forest had an evaporation 66·1 per cent. of that recorded in the grassland outside.

Rainfall: In the same period it was found that the rainfall inside the Pine plantations was 61 per cent. and 62 per cent. respectively of the rainfall recorded outside, whereas the corresponding figure for the open Eucalypt forest was 96 per cent. The differences between total annual rainfall and evaporation inside and outside the three forest sites are given. *Author's summary.*

11.2. *Climate*

11.22 : 11.11 : 11.14.7 : 91.3. Petrovski, Yu. S. Temperatura i vlazhnost' vozdukha v lesonasazhdeniyakh. [**The temperature and**

moisture of the air inside forests.] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (247–67). [Russ.] [551].

A review of the microclimatic observations made at Shiporsk and Istrinsk in 1938–39. The range of alterations in temperature inside a forest depends directly on the diurnal weather. Inside a forest warmth is absorbed by the canopy, whereas in the open it is absorbed by the surface soil. Diurnal modifications of the air temperature under forest cover start in the upper layer and spread downwards; in the open the changes spread from ground level upwards. The essential features of diurnal changes in temperature were found to be similar in Spruce and in Oak stands but the magnitude of the changes varied with the species. Under Spruce canopy mean temperature was 0·9 degrees lower than in the open and under Oak canopy it was 0·7 degrees lower; the average maximum temperature was correspondingly 1·0 degree lower under Spruce and 0·7 degrees lower under Oak. The greatest difference in air temperatures in forest and field occurred between 8 and 10 a.m. when that in the Spruce stand was 3·5 degrees lower than that in the open, but this lag is reduced as the temperature rises towards its maximum. During the winter there is no difference between air temperatures under forest and in the open; in the forest the vertical range of temperature is almost uniform except during a thaw, when it is much colder nearest the ground.

Differences between the air temperatures in forest and field are more pronounced in the strata up to 50 cm. than in the higher strata up to 200 cm. During the day, open country does not affect air temperatures under adjoining forest, as warm air in the open rises freely upwards and is rarely carried by wind to a depth of more than 60 m.; during the night cold air may spread for 100 m. into the forest.

Absolute humidity of air under forest is slightly higher than in the open, 0·4 mm. higher in Spruce and 0·6 mm. higher in Oak stands, owing to transpiration. Difference in relative humidity depends directly on temperature differences.

11.4. *Soil*

11.41. Soil Physics

11.41.1 : 91.3. Luchshev, A. A. **Dannȳe po vliyaniyu lesa na temperaturu pochvȳ. [Data on the influence of forests on the temperature of the soil.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (279–91). [Russ.] [552].

Observations made at Shipovsk in Oak forest and open field on soil temperatures at depths of 10 to 320 cm. Temperature at a depth of 10 cm. began to exceed that of the air by the beginning of May in the field and by the middle of August in the forest. The average temperature of the air above the soil surface was 6 to 10 degrees higher in the field than in the forest. The temperature in the upper horizon of field soil rose rapidly and evenly in March–April, but in the forest the rise was delayed and took place suddenly towards the end of April owing to late disappearance of snow. In November and December forest soil was warmer than that in the field at 50 cm., in February at 1 m. and by the end of summer at 10 cm. In winter the upper layers of the soil were colder than the lower horizons; in summer the temperature in the lower layers decreased proportionately with depth. At 320 cm. the soil was much warmer in January than in July, was warmest in October and coldest in May. The forest soil temperatures at 320 cm. were much higher than those in field soil throughout the year. The onset of stabilization of temperature was earlier in forest soil than in the field soil. There was no great difference in the average monthly temperature of either locality during winter, but during summer it was 2–3 degrees warmer at 40 cm. in the field than in the forest, and 2 degrees warmer at 1–2 m. The temperature gradient from the surface to 320 cm. was more rapid in field than in the forest soil, e.g. in July the difference was 23·9 degrees in the field and 13·3 degrees in the forest.

11.41.3 : 11.48–9 (729.7). Chenery, E. M., and Hardy, F. **The moisture profile in some Trinidad forest and Cacao soils.** *Trop. Agric., Trin.* 22, 1945 (100–15). [553].

This article describes the results obtained by periodically measuring the moisture profile at 17 sites representing 8 different soil types under forest or Cacao in Trinidad. The 17 sites are briefly described and laboratory data are tabulated to illustrate their main features.

11.41.7 : 07.7. Downes, R. G. **The use of the hydrometer for the mechanical analysis of soils.** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 17, 1944 (197–206 + plate). [554].

A study of the theory of hydrometers when used for the mechanical analysis of soils has been made and the various possible sources of error have been considered. These errors are:—

(1) Those associated with the conversion of density to percentage of soil in suspension.

(2) Those associated with the determination of the depth in the suspension at which the density is the same as that measured by the hydrometer.

(3) Those due to practical difficulties.

Results from a test hydrometer designed so as to minimize these errors have been compared with results obtained by the standard pipette technique for a number of soils. The mean of all differences, expressed as a percentage of the hydrometer reading and irrespective of sign, is about 5 per cent. This may be considered a creditable performance when allowance is made for the differences in dispersion technique used for the two methods. *Author's summary.*

11.42. Soil Chemistry

11.42.31 : 11.44 : 11.49 : 12.11.11 : 12.14.5 : 12.25–8. MATTSON, S., and KOUTLER-ANDERSSON, E. **The acid-base condition in vegetation litter and humus. I Acids, acidoids, and bases in relation to decomposition. II Acids, acidoids and bases in relation to soil types. III Acidoid formation in relation to base status. IV The strength of the acidoids and the relation to nitrogen.** *Lantbrukshögskolans Annaler* 9, 1941 (1–26, 27–37, 38–56, 57–73). Biol. Abstr. 19 (7954–7). [555].

Sixteen samples, including mature leaves and needles, were examined with respect to pH, acidity, 'excess base', organic acids, and acidoids, before, during and after decomposition for one year under aerobic and anaerobic conditions, with and without leaching.

The organic layers and the vegetation (including Beech, Spruce, and one sample of Pine) of 3 brown earths and 7 podzols were also examined with respect to the above and to pH_u (pH of electrodialysed samples) and exchange acidity. Beech leaves are higher in pH, bases and acidoids, but lower in acidity, organic acids, acid/base ratio and pH_u than Spruce and Pine needles. Beech grown on a brown earth is not only higher in bases but also in acidoids and acids than Beech grown on a podzol. Spruce grown on a brown earth has a higher pH, is higher in bases and acids, is lower in acidity and in the acid/base ratio than Spruce grown on podzol. But the Spruce grown on the brown earth is less basic than the Beech grown on the podzol. The pH_u values are related to the acidoid content and are lower in Beech than in Spruce or Pine. The N content shows a close relationship to the acidoid content except in some samples of litter such as Alder, which are abnormally high in N. Alder leaves yield a higher pH_u and possess the properties of weak acidoids.

11.43. Biology of Soil, including Mycorrhiza

11.43.1 : 12.21 : 44.3 : 12.26–8. WRIGHT, E. **Relation of macrofungi and micro-organisms of soils to damping-off of broadleaf seedlings.** *J. agric. Res.* 70, 1945 (133–41). O.R.E. [556].

An apparent relation was noted between the occurrence of soil macro-fungi and the damping-off of broadleaf seedlings such as *Ulmus americana*, *U. pumila* and *Robinia pseudoacacia*. There was a low incidence of damping-off in soils containing sporophores of *Cyathus vernicosus*, while an abundance of sporophores of *Naucoria semiorbicularis* and *Coprinus* spp. was associated with soils in which the incidence of damping-off was high. Soils containing the largest number of bacteria generally showed the least damping off (except where leguminous crops preceded the broadleaf seedlings) and nematodes seemed to be most numerous on soils on which cereal crops had been grown and on which damping-off losses were relatively light.

It does not appear likely, however, that studies in soil microbiology will prove of practical value in forecasting damping-off losses.

11.43.1 : 11.47.6 : 12.21. BRIAN, P. W., HEMMING, H. G., and MCGOWAN, J. C. **Origin of toxicity to mycorrhiza in Wareham Heath soil.** *Nature, Lond.* 155, 1945 (637–8). [Imperial Chemical Industries Ltd., Jealott's Hill Research Station, Bracknell, Berks.] [557].

Growth failure of conifers at Wareham Heath, Dorset, associated with toxicity of the soil to the mycorrhizal fungi of these trees, is now shown to be partly due to the production of fungistatic organic substances by *Penicillium* spp. (*P. janczewskii*, *P. jenseni* and strains of the *nigricans-janczewskii* series). The active

antibiotic substance produced by *P. jenseni* has been isolated in crystalline form identified as gliotoxin, which is found to be highly toxic to mycorrhizal fungi.

11.43.1 : 11.47.6. RAYNER, M. C. **Origin of toxicity to fungi in Wareham Heath soil.** *Nature, Lond.* 156, 1945 (174). [Bedford College, Univ. of London.] [558].

The discovery by Dr. P. W. Brian of the marked antibiotic activity of species of *Penicillium* present in Wareham soil [cf. previous abstract] is a notable contribution to our knowledge of the factors directly responsible for the observed inhibition of microbiological activity in this area. The distribution and abundance of the soil species of *Penicillium* is sporadic throughout the experimental area and is possibly influenced by seasonal conditions. Until further data are available it must remain an open question whether gliotoxin, as such, is responsible for limiting or suppressing the growth of mycorrhizal fungi, or whether it is one (possibly the main) cause of disturbances of microbiological origin resulting ultimately in soil infertility. The differential susceptibility of the various fungi to *Penicillium* spp. found by Dr. Brian is in agreement with observed facts. The endophyte, *Phoma*, for example, shows relatively slight susceptibility, and is consequently of wide distribution throughout the area in mycorrhizas of *Calluna*.

11.47. Maintenance of Favourable Soil Conditions

11.47.1 : 23.26.4. KARLSSON, K. G. Om gödsling i fasta plantskolor. [**Manuring in permanent nurseries.**] **Skogen** 32, 1945 (131–2). [Sw.] [559].

An account is given of the results obtained during twenty years' work, including 300 manurial trials, in the nursery at Ed, near Östhammar in the Province of Stockholm. Trials were made with green manures, with the cultivation of potatoes, and with artificial fertilizers of all kinds. In 1930 more than 6,000 earthworms were introduced into the soil.

Green manuring, which proved to be very costly, did not give any appreciable results. Of the artificials only the nitrogenous fertilizer 'Floranid' gave a positive result. The earthworms appear to have had a good effect on the soil. Compost manuring gave good results: Pine plants from compost-manured beds showed a markedly better 'trunk form' than those which had been grown in soil treated with other types of fertilizer. Detailed instructions are given for the making up of a compost heap.

Artificial watering during dry periods in the early summer resulted in plants showing greater susceptibility to frost and becoming somewhat lighter in colour, although there was no deficiency of nitrogen, and in increasing weeds to an alarming extent even with systematic weeding. R. P. J.

11.47.12 : 11.43.1 : 23.26.4. RAYNER, M. C. **Trees and composts.** *J. Minist. Agric.* 51, 1945 (567–9). O.B.D. [560].

Since 1933 the writer has been investigating the causes of poor tree growth on Wareham Heath (southern England) and elsewhere. This article gives a brief account of the Wareham experiments and the successful use of compost treatments to re-establish soil fertility [cf. *For. Abstr.* 6 (138, 139).]

11.47.13 : 11.43.1 : 23.26 : 12.25. WILDE, S. A., and ROSENDAHL, R. O. **Value of potassium feldspar as a fertilizer in forest nurseries.** *J. For.* 43, 1945 (366–7). [Soils Department, Univ. of Wisconsin.] [561].

Experiment has shown that ground orthoclase feldspar is a suitable source of potassium for Jack Pine and Red Pine seedlings raised in quartz sand cultures; the planting stock used was obtained from nursery beds at the age of 7 weeks and was profusely inoculated with mycorrhizae [cf. *For. Abstr.* 6 (7)]. Application of ground feldspar at the rate of 3 tons per acre provided sufficient potassium to maintain a satisfactory rate of growth of seedlings of both species.

The use of feldspars and other potash-bearing minerals or rocks to replace commercial potash fertilizers in forest nurseries has advantages in economy and in reducing the fluctuation of soluble salts in nursery soils.

However, as the concentration of potassium in the tissues of feldspar-grown seedlings is considerably lower than in seedlings produced with potassium chloride, it is suggested that in regions subject to frost damage the applications of potash-bearing rocks should be supplemented with light treatments of readily soluble potash salts, applied either broadcast or as a liquid fertilizer.

11.47.2 : 23.21 : 12.25 : 12.26–8. AUTEN, J. T. **Relative influences of Sassafras, Black Locust and Pines upon old-field soils.** *J.*

For. 43, 1945 (441–6). [Central States Forest Exp. Sta., Columbus, Ohio.] [562].

Restoration of forests on 75 to 80 per cent. of the area of abandoned fields in the central hardwood region of the United States cannot be done directly with desirable hardwoods because of soil deterioration from cultivation and erosion. A preliminary crop is necessary, which can endure site dryness, lay down a litter cover, and thereby make possible the restoration of surface soil structure and water-absorbing capacity. A study has been carried out in abandoned field lands in Illinois, Indiana and Ohio to determine the value as soil conditioners of Sassafras (*Sassafras officinale*), Black Locust (*Robinia pseudoacacia*) and Pines (*Pinus* spp.). All species studied increased surface soil infiltration rates. Sassafras contributed most completely to restoration of a hardwood forest soil but, because of its limited economic value, the chief use of this species is primarily that of a nurse crop. Black Locust may be planted on the best old-field soils as a commercial crop, and as a nurse crop on intermediate sites. Pines are most useful on the drier old-field soils to prepare the way for eventual succession of native hardwoods.

11.48. Soil Classes according to their Basic Material

11.48–9 (41.5) : 11.45 : 64. GALLAGHER, P. H. **Some aspects of soil classification.** With discussion. *Irish For.* 2 (1), 1945 (5–11, 45–8). [563].

The paper gives a general account of the problems of soil classification. The writer ascribes the failure to provide a satisfactory system of soil classification in earlier times to an exclusive consideration of geological factors, and more recently to an almost equally exclusive preoccupation with weathering processes and neglect of underlying geological formations. Ireland presents a peculiar problem, owing to the comparative immaturity of many of the soils, due to glaciation in relatively recent geological times. To ascertain the general character of a soil, it is necessary to consider its whole profile, which comprises a vertical section to the depth to which roots and weathering influences have penetrated. Where there is substantial identity between whole profiles, there will be found substantially similar natural adaptability to one or other kind of vegetation. Caution is necessary in using vegetation as an indicator of site value, and consideration of the whole plant community or association is a more reliable guide than the presence or absence of a single plant. Moreover, the general plant association will sometimes be found to vary with environment even where soil conditions may not be materially different. Elevation and wind exposure have a notable influence in this respect.

11.49. Soil Types

11.49.0 (71.4) : 11.41.7 : 11.42. RICHARD, J. A. **Studies on the nature of podzolization.** *Abstr. Theses Cornell Univ. 1943*, 1944 (406–10). Cornell Univ. Press, Ithaca, N.Y. E.S.R. 93, 1945 (11). [564].

Detailed analyses are presented, including mechanical composition of the soil, organic matter, heat of wetting of total soil and of organic-matter-free soil, pH, and mineralogical composition of the sand fraction; and chemical analyses of the colloids are presented for well developed podzol under two different forest types. The soil samples were collected under hard- and softwood forest types in southeastern Quebec. The soil was developed from a ground moraine derived mostly from rock consisting of schist and sandstone.

11.49.3 (931) : 11.42.31 : 11.42.33. FIFE, C. V. **Study of a yellow-grey loam in the Manawatu.** *N.Z. J. Sci. Technol.* 26, 1945 (281–93). P.R. [565].

The morphology and field characteristics of the soil are described.

The analytical data reveal the satisfactory base content of the surface soil under rain forest, but point to a marked reduction in the base exchange capacity and an increase in unsaturation in soils from which the forest has been cleared for a considerable number of years.

Iron has moved downwards in the profile, and it is concluded that the greater part of this iron has become segregated in the concretionary material which is mainly concentrated in the upper portion of the B horizon. *Author's summary.*

11.6. *Hydrographical Conditions. Water and Soil Conservation*

11.62 : 91.3 : 12.25 : 12.11.14. STÅLFELT, M. G. Granens vattenförbrukning och dess inverkan på vattenomsättningen i marken. **[The water consumption of Spruce and its influence on the water régime of the soil.]**

K. LantbrAkad. Tidskr. 83, 1944 (425–505). [Sw.e.] A.P.B. [566].

The author makes an attempt to analyse quantitatively the water consumption and interception by Spruce in relation to the available water supply. Investigations were carried out chiefly with 40-year-old trees (8 growing on fairly dry ground and 3 on moister soil where ground water was available at a depth of only 0·2 m.) in a stand situated on moraine soil in northern Scania. Data are given on the amount of transpiration of the trees, on the interception and retention of precipitation by the tree crowns and by the coniferous and moss litter, on the influence of ground water, and on cuticular absorption by the Spruce needles. On the basis of needle weight, young Spruce consumed considerably more water than older trees. Spruce on dry sites, where the roots were not in direct contact with ground water, showed approximately the same amount of transpiration as those on moist sites when the ground was plentifully watered (e.g. after copious rainfall), but during dry periods the amount of transpiration of the trees on dry sites was considerably reduced, whereas that of the trees on moist sites remained practically unchanged. Interception of precipitation by the Spruce crowns amounted to over 50 per cent. of the precipitation on open ground while interception by the soil cover (moss and litter) ranged from 9 to 18 per cent. Considerable quantities of water were absorbed through the cuticle of the Spruce needles, particularly when there existed a state of water deficiency. The precipitation which reached the root zone of the trees during a year was greater than the amount of transpiration in the dry locality, but was less than the amount of transpiration in the moist locality.

11.62 : 91.3. RUTKOVSKI, V. I. Gidrologicheskaya rol' lesa i lesnoe khozyaystvo. **[The hydrologic rôle of forests and forest management.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (65–112). [Russ.] [567].

This article on the hydrologic rôle of the forest is chiefly based on extracts from the extensive Russian literature on the subject, with a concluding summary. [See following abstracts.]

11.62 : 11.14.4 : 91.3. RUTKOVSKI, V. I., and KUZNETSOVA, Z. I. Vliyanie nasazhdeni na snegovoy rezhim. **[Influence of stands on the snow régime.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (149–79). [Russ.russ.] [568].

Investigations on the effect of forest cover on the accumulation and thaw of snow show that mature broadleaved stands hold the maximum reserve of snow, and almost as much is held by small forest meadows and young stands up to a few hectares in area; in young stands extending continuously over large areas the accumulation of snow is much the same as in open country. Thawing and surface evaporation are responsible for this variation in depth of snow in young crops. In Pine and Spruce stands the snow reserve differs considerably in hard winters, when it is 10–20 per cent. less in Pine and 30–50 per cent. less in Spruce than in broadleaved stands. Second-storey Spruce under Pine decreases the snow reserve by 10 per cent. at a density of 0·1–0·2, and by 20–25 per cent. at a density of 0·3. In coniferous stands the snow reserve in winters with frequent thaws is 60–70 per cent. less than in broadleaved stands. The rate of thaw in coniferous stands is $\frac{2}{3}$ to $\frac{1}{2}$ of that in broadleaved stands and in forest meadows; thus, in spite of the smaller accumulation of snow, thawing is more protracted. The depth to which soil freezes depends on the amount of snow cover present during frosts. Severe frost before snowfall produces the greatest depth of freezing in open places and broadleaved woods and least in coniferous woods. If snowfall precedes frost then the soil under conifers freezes deeper than that in more exposed places.

With the practical object of increasing the infiltration of water into the soil the following silvicultural measures are advised. Spruce stands should have a density of 0·7–0·8; mixed Spruce and broadleaved stands are better than pure Pine; thin out understoreys of Spruce or remove completely where heavy weed growth is not likely to follow; clear fellings should be 100 to 200 metres wide.

11.62 : 91.3 : 11.41.5–6. KHARITONOV, G. A. Vliyanie sostava nasazhdeni na vodopogloshchenie. **[Influence of the composition of the stand on the absorption of water by the soil.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (181–195). [Russ.] [569].

Experiments were made in the Obolensk region to determine water absorption and evaporation under different types of forest cover

in 5 comparable plots of pure Birch, Larch, Oak, Lime and Spruce; owing to previously dry weather, the water absorption recorded during the experiments was unusually high. It was found that the water-absorbing capacity of the soil during short exposure (e.g. to a rain shower) was 7 mm. per minute, and that during a long period of exposure the capacity was determined by the B–C and C horizons where the rate of penetration is ½ to ⅓ of that in the surface levels. As to the effect of the stand, Oak showed the highest water-absorption capacity, Lime almost as high; Birch showed the lowest capacity under short exposure, and Spruce the lowest under longer exposure. Soil under Larch had a high capacity with short exposure, and was equivalent to Lime with longer exposure. Undergrowth considerably weakened the spring flow but did not affect the rate of absorption in summer. It is recommended that Oak (preferably) and Lime (as an understorey) should be planted for the objects mentioned.

11.62 : 91.3 : 12.25 : 11.41.5–6. Sozȳkin, N. F. Vliyanie lesa na vodnȳe svoystva pochv. **[Influence of the forest on the water-retaining properties of soil.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (197–231). [Russ.] [570].

Active porosity of forest and agricultural soils decreases with depth; this does not apply to strong podzol soils in open uncultivated areas. Active porosity of the upper horizons marks the difference between medium and strong podzols. There is a marked difference between a strong podzol under forest and that on uncultivated land, the latter being subject to bog formation. A Spruce plantation on suglinok soil does not use the moisture of the deeper horizons and does not significantly change their nature. Such plantations influence the water supply of rivers through interception of precipitation, their effect on period and rate of thaw and depth of soil freezing, and especially the great water-absorption capacity of the soil in heavy rainfall. By retarding the thaw of snow, forest cover prolongs the period of infiltration and build-up of ground water, the quantity of which depends on the saturation of the soil either by surface run-off or by movement of sub-surface water. The depth of soil freezing and the rate of thawing both vary with moisture content of the soil, consequently soils with high moisture content begin to thaw later and the rate is slower. Frozen soil is permeable but a surface crust of ice hinders permeability. Active porosity of soil under forest is 3 times that of pasture land, and higher in medium than in strong podzol soil. Thus the greater part of the sub-surface flow may be retained on a forested gradient for 3 to 5 days longer than the surface run-off on fields.

11.62 : 91.3 : 11.14 : 11.22. Luchshev, A. A. Osadki pod pologom lesa. **[Precipitation under the forest canopy.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (113–48). [Russ.] [571].

In classifying forest growth with reference to water conservation, the nature of the canopy should be used as the criterion. From an investigation made in 1938–39 in six types of forest, it was found that a Spruce canopy retained the largest amount of rainfall, 28–37 per cent., Pine retained 25 per cent., and Oak 15–22 per cent. Intensity of rainfall, temperature and humidity of the air, and wind velocity all affect the amount of precipitation retained by the crowns up to about 5 mm. of rain, the amount retained by both broadleaved and coniferous foliage increasing directly with the increase in intensity of the precipitation; when the limit of retention has been reached the excess of water trickles through and flows downwards. The amount of rain retained by the boles of Spruce or Pine is insignificant; the greatest flow of rain water was observed on Aspen boles. An exact calculation of the percentage of rainfall intercepted by a given type of forest cover in a catchment area must be based on the rate, quantity, and frequency of the rainfall.

11.62.1 : 91.3. Koplan, S. I. Vliyanie lesa na poverkhnostnȳ stok. **[Influence of the forest on the surface run-off.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (233–46). [Russ.] [572].

Observations made at Istrinsk, Oksk and Goretsk in 1939 in stands of Spruce, Larch, Pine and Oak and in meadow and arable land. The duration of the spring flow is increased, its peak is later and its volume is 2 to 3 times smaller from land under forest than in the open. Long strips of forest growing along ravines on degraded chernozem absorbed the surface run-off from higher adjacent fields to the extent of

19–51 per cent. on 40 m. strips, and up to 76 per cent. on 60 m. strips; this is in addition to their positive influence on water absorption by the soil they occupy. Surface run-off was less than 20 per cent. from Spruce stands on suglinok (unfavourable conditions), and only 1·1 per cent. from Oak stands on degraded chernozem (favourable). Hence it is clear that 80–90 per cent. of the total annual precipitation on the forest was used up in evaporation, transpiration and accumulation in the form of ground water, which was available to replenish the rivers in summer.

11.62.1 (68.7) : 23.3. GOHL, O. R. **Drift sand reclamation and coast stabilization in the South Western Districts of the Cape Province.** *J. S. Afr. For. Ass.* No. 12, 1944 (4–18 + plates). [573].

An account of the drift-sand menace in the coastal areas of the southwestern Cape Province, describing contributory causes and control measures. Arguments are given for the rigid exclusion of grazing, for building a littoral dune parallel to the coast planted only with marram grass (*Ammophila arenaria*), and the use of brushwood laid in strips or carpets, for which practically all indigenous duneveld species are useful. More natural methods of coast stabilization are preferred to the construction of high artificial littoral dunes. On the partially stabilized dunes the natural ingress of herbaceous and woody species is assisted by sowings of *Sutherlandia frutescens* and *Myrica cordifolia.*

11.62.1 (79.2) : 12.19.3. WOODWARD, L., and CRADDOCK, G. W. **Surface run-off potentials of some Utah range-watershed lands.** *J. For.* 43, 1945 (357–65). [Intermountain Forest and Range Exp. Sta., Ogden, Utah.] [574].

An indication of the effect of plant cover on infiltration capacity was given in a series of infiltrometer tests which were made in 1941 on nine of the most common plant-soil complexes within the Sevier Lake Basin in Utah. The tests were divided about equally between three major range types: (1) herbaceous areas on headwater lands at elevations of from 8,000 to 10,000 ft.; (2) browse areas on slopes at elevations of from 6,500 to 8,000 ft.; and (3) Sagebrush/Piñon/Juniper areas on foothill and bench lands at elevations of from 5,000 to 7,000 ft. All three plant cover types were tested on areas having relatively loose soil derived from igneous materials and on areas of compact soil derived from sandstone. A wide range of plant cover density was tested within each of the nine plant-soil complexes, for each 5 per cent. of plant-cover density up to 35 per cent. These investigations show that variation in infiltration capacity was due not only to differences in plant cover and parent soil material but also to differences in plant-cover density. In general, browse areas exhibited the greatest infiltration capacity, followed by Sagebrush/Piñon/Juniper and the herbaceous range. On areas within the same plant-soil complex, the final infiltration rates in all cases not only decreased, but were attained progressively sooner, with a decrease of plant-cover density.

11.62.11 : 94.4 (54.5). SINGH, B. **Bhatrana *Cho* Reclamation Co-operative Society, District Hoshiarpur.** *Indian For.* 71, 1945 (156). [575].

A brief account of an Indian village co-operative formed in 1939 to take action against threatened damage from flooding. Out of 531 uncultivated acres of the village lands, 441 acres were closed to cattle grazing. The banks of the ravines were thickly planted with *Phragmites karka* to a width of 30 ft. Spurs of *Vitex negundo* and brushwood were constructed to divert the water. Within 2 years the banks were fixed and danger averted. Other works of improvement were then undertaken by the society, including the planting of 60,000 Shisham (*Dalbergia sissoo*) root and shoot cuttings on 150 acres of non-cultivable land to provide fuel and timber for the village.

11.62.2–3 : 91.3 : 11.3–4. SMARAGDOV, D. G. Rol' lesa v bor'be s melkovod'em rek. [**The rôle of the forest in preventing low water in rivers.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 18, 1940 (5–64). [Russ.russ.] [576].

It is generally recognized that forest cover is more effective than open country in maintaining the supply of water to rivers, particularly through its store of ground water. The basic factors governing the replenishment of ground water lie in the structure of a forest soil and the presence of litter, moss and/or herbaceous ground cover, whereas the general physio-geographical factors are physical relief, depth of ground water, permeability and water-retaining features of the soil and climatic conditions.

These general factors must be studied before the influence of forest cover on ground water can be exactly defined, even for small areas, and at present there is not enough information to classify forest types or territories according to water-conserving characters. The author, therefore, suggests a comparative grouping based on differences in factors that contribute to the supply of ground water, viz.:

(1) Favourable factors such as: (*a*) capillary zone of ground water not rising higher than the horizon underlying the root zone; (*b*) considerable gradient and relatively poor infiltration of the adjacent field soil creating favourable conditions for surface run-off (spring flow coefficient 0·5 and over); (*c*) permeable and non-retentive soils in the horizon between the roots and the ground water; (*d*) accumulation of a thick snow layer, and significant percentage of the precipitation as thunderstorms and rain causing surface run-off in the open; (*e*) forests with accumulation of litter, and poor development of moss and herbage; plantations with well developed root systems; (*f*) litter and soil undisturbed by grazing animals or scraping of litter; (*g*) additional supply of water from surface run-off or snow blown in from open areas.

(2) Neutral factors by which the ground water under forest does not differ significantly from that of arable and meadow land, e.g.: (*a*) depth of ground water allowing a temporary rise of the capillary zone into the root zone during the vegetative season; (*b*) gradient of adjacent open areas and permeability of field soil creating conditions for a spring surface run-off coefficient less than 0·5; (*c*) permeability equivalent to the average of sand and clay; (*d*) significant amount of winter, thunderstorm and rain precipitation; (*e*) absence of external sources of water.

(3) Diminishing factors exhibiting the drying influence of forest cover: (*a*) ground water near the surface and the capillary zone not falling below the root system for most of the vegetative season; (*b*) low gradient and high permeability of the soil and subsoil of adjacent open areas causing saturation in spring, or complete absorption and retention of surface run-off where the ground water is very deep and the soil highly absorbent.

It is not yet possible to classify these 3 groups according to other important factors affecting the gain and loss of ground water, but for all practical purposes one may consider that forest stands in group 1 satisfactorily maintain the ground water, those in group 2 in many cases are satisfactory, and those in group 3 only exceptionally accumulate ground water.

11.62.22. Li, Lai-Yung. **The effect of some surface conditions of the soil on infiltration of water in woodland and in cultivated orchard.** *N.Z. J. Sci. Technol.* 25, Sect. A., 1943 (86–90). [Plant Research Bureau D.S.I.R., N.Z.] O.R.S. [577].

Measurements are given of physical characteristics and water infiltration in a soil under broadleaved forest and in apple orchard. It is shown that the rate of infiltration in the soil under forest is more than double what it is under orchard cultivation. In the forest soil, little difference was shown in rate of infiltration whether the litter was in place, was removed, or the soil was cultivated. In the orchard, rate of infiltration was slightly higher following recent cultivation and much lower under compacted traffic-ways.

11.62.31 : 11.62.11 (73). Frank, B., and Munns, E. N. **Watershed flood control: performance and possibilities.** *J. For.* 43, 1945 (236–51). [U.S. Forest Service, Washington, D.C.] [578].

The article criticizes in general terms the various published reports of progress under the U.S. Flood Control Act of 1936. An important development is the greater attention now given to watershed flood control which is effected by such practices as fire control, grazing management, and road stabilization.

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11 : 12.14.1 : 31.1. Jaccard, P. Fonctions physiologiques des éléments constitutifs du bois. [**Physiological functions of the constituent elements of wood.**] *J. for. suisse* 94, 1943 (183–7). [F.] [579].

The three anatomical elements of which wood is composed are (1) the vessels or tracheids which conduct water and mineral substances absorbed by the roots; (2) the fibres which give the necessary structural support, and (3) the woody parenchyma cells in which are stored the substances manufactured by the leaves and not needed immediately for growth. The physiological functions of these constituent elements are discussed briefly.

12.11.1. *Metabolism. Plant Constituents. Growth Substances*

12.11.11 : 12.25 : 12.11.22. MIROV, N. T. **Effect of the crown on the composition of oleoresin in Pines.** *J. For.* 43, 1945 (345–8). [Institute of Forest Genetics, California Forest and Range Exp. Sta., Berkeley, Calif.] [580].

A method for determining what influence the tree crown has on the composition of oleoresin in Pines would be to select two Pine species that possess oleoresins of different chemical composition, graft the crown of one to the stem of the other, and observe the influence of the scion on the chemical composition of the oleoresin of the stock. In the experiments described in this paper, the two species used were Digger Pine (*Pinus sabiniana*), the oleoresin of which contains small quantities of aldehydes whose presence is easily tested, and Ponderosa Pine (*P. ponderosa*), the oleoresin of which contains no aldehydes. A Digger Pine crown was grafted on a Ponderosa Pine stem at a height of 7 ft. from the ground and a Ponderosa crown was grafted on a Digger Pine stem at the same height. Nearly three growing seasons after the grafting was done, samples of oleoresin taken from the stem of the Ponderosa Pine on which the Digger Pine crown was grafted showed the presence of aldehydes, whereas in the alternate arrangement no traces of aldehydes were present in the samples taken from the Ponderosa Pine crown or from the Digger Pine trunk just below the graft. Faint traces of aldehyde were found, however, in the trunk below a single whorl of suppressed branches which had been left on the trunk below the graft. These experiments indicate that the chemical composition of the oleoresin of Pine trunks alters under the influence of a foreign crown, and the transformation of transported substances into oleoresin is evidently governed by some unknown factor supplied by the crown of the tree.

12.11.11 : 12.26–8. GUHA, P. C., and BHATTACHARYYA. **Studies in the santalol series. Part I. Separation of the santalols and the santalenes. Part II. Synthesis of *d*- and *dl*-$^{\pi}$-hydroxycamphor, *d*- and *dl* teresantalol and *d*- and *dl*-tricycloeka-santalic acid. Part III. Syntheses of *d*-$^{\alpha}$-santalal and *d*-$^{\alpha}$-santalol.** *J. Indian chem. Soc.* 21, 1944 (261–84). [Organic Chemistry Laboratories, Indian Institute of Science, Bangalore.] O.R.S. [581].

The alcohols, α- and β-santalols, have been isolated from East Indian Sandalwood oil, obtained from the heartwood of *Santalum album*. Both α- and β-santalenes have also been obtained. An account is given of their synthesis.

12.11.11 (931) : 12.26–8. WHITE, E. P. **Alkaloids of the Leguminosae.** *N.Z. J. Sci. Tech.* 25, Sect. B., 1943 (93–114, 137–62). [Chemical Laboratory, Animal Research Division, Department of Agriculture, Wellington.] O.R.S. [582].

A systematic study is being made to determine the alkaloid-content of legumes in the Southern Hemisphere. About 210 species, representing 68 genera, have been examined for alkaloids. Tree species investigated are *Laburnum vulgare*, *Acacia hakeoides*, *A. linifolia*, *A. linifolia* var. *prominens*, *A. lunata*, *A. pravissima*, *A. suaveolens*, *A. cultriformis*, *A. podalyriaefolia*, *A. longifolia*, *A. floribunda*, *A. pruinosa*. Details are given of the experiments and findings.

12.11.11 : 12.14.4–5 : 34.25. BURKHOLDER, P. R., and MCVEIGH, I. **The B vitamin content of buds and shoots of some common trees.** *Plant Physiol.* 20, 1945 (276–81). [Osborn Botanical Laboratory, Yale Univ.] O.B.D. [583].

Microbiological assays are reported for thiamine, riboflavin, pyridoxine, niacin, inositol, biotin, pantothenic acid, and vitamin B_c occurring in the buds and leaves or shoots of 18 kinds of woody plants. The possible significance of the data for studies on growth and for problems in the conservation of wild life is discussed briefly. *Authors' summary.*

12.11.11 : 12.26–8 : 12.14.4–5. CUNNINGHAM, I. J., and HOPKIRK, C. S. M. **Experimental poisoning of sheep by Ngais (*Myoporum laetum*).** *N.Z. J. Sci. Technol.* 26, 1945 (333–9). P.R. [584].

New Zealand Ngais (*Myoporum laetum*), a small tree 8–25 ft. high, is known to be poisonous to animals. The leaves and twigs of this tree are very palatable, particularly if, through storms and tree-falls, they become available when other fodder is short. Sheep and rats are particularly susceptible to poisoning, and experiments were carried out to obtain detailed information on the effects of doses of varying sizes. Doses of 7½ g. dried leaves per kg. bodyweight killed sheep in approximately eighteen hours. Smaller doses caused depression, loss of appetite, icterus and photosensitivity. Larger

doses were required to have a similar effect on rats.

Tasmanian Ngais (*Myoporum serratum*), a decorative garden shrub, was also tried and was found to be less poisonous than the closely-related New Zealand species. Doses of fried berries and wood from *M. laetum* proved non-toxic but the essential oil had toxic properties similar to those of the leaves.

12.11.11 : 12.26–8 : 12.14.7. HILDITCH, T. P., and MEARA, M. L. **The fatty acids and glycerids of solid seed fats. XII. *Lophira alata* kernel fat (Niam fat).** *J. Soc. chem. Ind., Lond.* 63, 1944 (114–5). [Liverpool Univ.] O.R.S. [585].

Lophira alata produces nuts containing 60 per cent. of kernels which yield about 40 per cent. of a yellowish fat, semi-solid at ordinary temperatures. The component acids of the fat include myristic 1·9, palmitic 27·1, behenic 14·2, lignoceric 2·3, tetra- and hexa-decenoic 1·5, oleic 14·5, linoleic 33·3, and docosenoic 5·0 per cent. (weight). The component glycerides are of the usual mixed type.

12.11.11 : 12.26–8 : 12.14.7. VENKATA RAO, C., and NARASINGA RAO, M. **Chemical examination of the seeds of *Vateria indica*.** *J. Indian chem. Soc.* 20, 1943 (239–42, 298–300). [Andhra University, Guntur.] O.R.S. [586].

The fat from the seeds of *Vateria indica* contains 92·6 per cent. insoluble mixed fatty acids composed of 60·7 per cent. solid acids and 39·3 per cent. liquid acids. The composition of the fatty acids is lower acid 0·2, myristic acid 0·7, palmitic acid 13, stearic acid 45·1, arachidic acid 0·4, oleic acid 42·5 and linoleic acid 0·1 per cent. The non-saponifiable matter is mainly composed of sitosterol. On steam-distillation the fat yields 0·05 per cent. of a terpenoid oil having an iodine value of 148. The component glycerides are tri-stearin 2·5, oleo-distearin 44·9, oleo-palmitostearin 16·6, oleo-dipalmitin 7·1, dioleo-stearin 15·8, dioleo-palmitin 13 and triolein 0·2 per cent. The fat would be suitable for use in confectionery, for soap-making, and as a source of stearic acid.

Vateria indica is a large evergreen tree found in Mysore, South Canara, Malabar and Travancore.

12.11.11 : 12.26–8 : 12.14.8. CHAKRAVARTI, D., and GHOSH, R. P. **Crystalline components of the bark of *Prunus puddum* Roxb. Part I. Identity of puddumetin with genkwanin.** *J. Indian chem. Soc.* 21, 1944 (171–4). O.R.S. [587].

Three crystalline products have been isolated from the bark of *Prunus puddum* Roxb. These have m.ps. 278–80°, 150–52° and 237–38° respectively. The compound, m.p. 278–80°, which has been named puddumetin, now appears to be identical with genkwanin (7-methylapigenin), isolated from the Chinese drug 'Yuen hua'.

12.11.11 : 12.26–8 : 12.14.8. LAFORGE, F. B., and BARTHEL, W. F. **A new constituent isolated from southern Prickly-Ash bark.** *J. org. Chem.* 9, 1944 (250–3), O.R.S. [588].

The bark of Southern Prickly Ash (*Zanthoxylum clava-herculis*) has previously been reported as a source of asarinin of known structure and possessing the property of increasing the toxic effect of Pyrethrum to flies. The presence of an insecticidal principle in this plant has also been noted. In attempts to isolate the insecticidal agent, a compound was isolated which is chemically related to adrenaline and ephedrine, and has been determined as N-(2-*p*-anisylethyl)-N-methyl-cinnamamide. It does not represent the insecticidal principle of the plant, for tests show it to be without effect on flies and in combination with asarinin its toxicity is slight. Its synthesis is described.

12.11.11 : 12.26–8 : 12.14.8. CHAKRAVARTY, K. K. **On the alkaloid isolated from the matured bark of *Aegle marmelos* Correa.** *J. Indian chem. Soc.* 21, 1944 (401–3). [Univ. College of Science and Technology, Calcutta.] O.R.S. [589].

The alkaloid isolated from the mature bark of *Aegle marmelos* (Bihar variety) is identical with γ-fagarine, an alkaloid previously isolated from the leaves of *Fagara coco*.

12.11.12 : 11.41.3 : 31.22.3. KRAMER, P. J. **Absorption of water by plants.** *Bot. Rev.* 11, 1945 (310–55). [Duke Univ., North Carolina.] [590].

This comprehensive review is concerned primarily with the nature and origin of the forces bringing about the movement of water from soil and other media surrounding roots into the conducting elements of the xylem, and with those internal and external factors which affect the rate of such movement. A list of 273 references to the literature is given.

12.11.12 : 31.22.3. KRASULIN, N. P. O soobshchaemosti godichnykh sloev drevesiny v svyazi

s vodnȳm balansom dereva. **[On the permeability of annual layers of wood in connection with the water balance of the tree.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 21, 1941 (119–36). [Russ.] [591].

The transverse permeability of annual layers of wood was investigated by: (*a*) colour filtration through sections of second-year shoots, reproducing the natural movement of water in wood; and (*b*) the 'potometric' method for second-year shoots, with separate measurement of the water taken up by 1-year-old and 2-year-old wood. In general, the same results were obtained by both methods but Pine and Aspen behaved anomalously.

The investigated species may be divided into two categories:—(1) Species with good permeability of annual rings—*Betula pubescens, B. verrucosa, Acer platanoides, Salix alba, Alnus incana, Sorbus aucuparia, Corylus avellana, Juglans cinerea, Aesculus hippocastanum, Ulmus effusa, Populus alba, P. tremula* and *Pinus sylvestris.* (2) Species with poor permeability of annual rings—*Fraxinus excelsior, Quercus pedunculata, Caragana arborescens, Abies sibirica, Larix sibirica, Pinus cembra.*

12.11.14. KRASULIN, N. P. K metodike opredeleniya transpiratsii dereva (metod bȳstrogo vzveshivaniya srezannȳkh pobegov). **[A contribution to methods of determining the transpiration of trees (method for the rapid weighing of cut shoots).]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 21, 1941 (51–72). [Russ.russ.] [592].

Using a special balance weighing up to 300 mg. and accurate to 6 mg. tests were made of the transpiration rate of shoots of Birch, Oak and Pine cut in vaseline. It was deduced that in a Pine tree in a dry summer the rate of transpiration does not at first depend on the age of the shoot, but from midsummer onwards transpiration is strongest from the current year's shoots, the condition gradually changing until by the end of the summer most vigorous transpiration occurs in the top of the crown and in tips of the current year's shoots, while the lowest transpiration rate occurs in the lower crown.

12.11.2. *Propagation. Growth. Development*

12.11.21 : 12.25 (942 : 944) : 12.14.7 : 11.2. MILLETT, M. R. O. **Pollen shed of Monterey Pine.** *Leafl. Commonw. For. Bur. Aust.* No. 59, 1944. pp. 8. [593].

The beginning, peak and end of pollen shed of Monterey Pine (*Pinus radiata*) in two climatically different areas in Australia are noted and discussed. At Canberra, nearly 2,000 ft. above sea-level, pollen shed lasts rather less than 3 weeks and commences when shedding has almost ceased at Mt. Burr, which is near the sea at 200 ft. above sea-level in South Australia. In the latter area shedding lasts 7 weeks. Air and soil temperatures associated with the first ripening of the male flowers are about the same in the two localities, and the extension of the pollen season is more closely related to sunshine, evaporation and wind than to other meteorological factors.

12.11.21–2 : 12.25–8 : 23.26. HOF, M. VAN. **Successful plant propagation.** *Amer. Nurserym.* 81 (9), 1945 (9–10). [594].

Practical advice on the seeding of evergreens, the use of hardwood and softwood cuttings, and propagation by grafting.

12.11.22 : 12.25 : 12.11.15. FARRAR, J. L., and GRACE, N. H. **Vegetative propagation of conifers. X. Effects of season of collection and propagation media on the rooting of Norway Spruce cuttings.** *Repr.* from *Canad. J. Res.* 19, Sect. C., 1941 (391–9 + plate). [*N.R.C.* No. 1010.] [595].

Twenty-four collections of Norway Spruce [*Picea abies*] cuttings were taken, seven about the time new growth was forming, six at semi-monthly intervals from July to September, four during October, and seven at monthly intervals during the winter to April, and were propagated in outdoor frames in several media. The proportion of cuttings rooting in sand was low for the summer collections but reached 80 per cent. or higher for collections made in September and October. The addition of sedge peat effected rooting of 90 per cent. in collections taken throughout summer and autumn, and increased the number of roots, length of root, and the development of new growth. Sphagnum peat added to the sand was also slightly beneficial but, for propagation, much inferior in effect to the sedge type of peat. Varying the proportion of peat or the texture of the sand had no significant effect except on the length of root, which was greater in those media rich in peat. Cuttings stored over winter or taken in spring did not respond well. *Authors' summary.*

12.11.22 : 12.25 : 12.11.15. FARRAR, J. L., and GRACE, N. H. **Vegetative propagation of conifers. XI. Effects of type of cutting on the rooting of Norway Spruce cuttings.** *Repr.* from *Canad. J. Res.* 20, Sect. C., 1942 (116–21 + plate). [*N.R.C.* No. 1037.] [596].

Full length Norway Spruce [*Picea abies*] cuttings, with and without a heel of old wood, were collected from the lower part of the tree at semi-monthly intervals from July to October and were propagated in several media in outside frames.

Plain cuttings generally rooted better than cuttings with a heel of old wood, as judged by percentage rooted and the number and lengths of root. Heels, however, for summer collections favoured survival and rooting in sand, and root length in sand-peat. In several experiments involving early spring collections propagated in sand, the presence or absence of heels had little effect on the responses of the cuttings.

A late October collection involved six types of plain cuttings taken from the lower part of the tree and propagated in two different sand-peat media. In sedge peat medium there was little difference in the rooting of second order terminal, second order large lateral, second order small lateral, or third order lateral cuttings, the average rooting being 90 per cent. Third order lateral cuttings showed an inferior development of new growth. The percentage of first order terminal cuttings rooted was 67 per cent.; these had markedly superior new growth development; when shortened, only 32 per cent. of such cuttings rooted. Irregular differences between the types of cutting occurred in the inferior sphagnum peat medium. *Authors' summary.*

12.11.22 : 23.24.1. PRAVDIN, L. F. Vliyanie velichinȳ i vozrasta drevesnȳkh cherenkov na ikh ukorenenie. [**Influence of the size and age of cuttings of woody plants on their rooting capacity.**] *Sovetsk. Bot.* No. 2, 1944 (28–37). [Russ.russ.] O.B.D. [597].

An account is given of experiments with green cuttings of *Salix caprea*, *Populus laurifolia*, and *Syringa vulgaris*, to determine the effect of age and size on rooting. Four types of cuttings were used:—(*a*) Leaf with petiole; (*b*) Leaf-bud with a piece of wood; (*c*) One node and two leaves; (*d*) 2 nodes and 3 leaves.

Increased size of cuttings whether in length (1 or 2 nodes) or number of leaves, did not affect rooting. Leaves with petiole but without a bud guaranteed callus and root formation, but did not give rise to shoots. Treating these four types of cutting with heteroauxin, either in a dry talc/chalk mixture or in fluid form, favoured the process of regeneration.

So far as position on the shoot is concerned, the best rooting was obtained with cuttings from the middle of the shoot, those from the top or base of the shoot failing to root. This unequal rooting ability is explained by Krenke's theory of cyclic ageing and rejuvenation.

12.11.22 : 12.26–8 : 12.11.15. PRAVDIN, L. F. Vliyanie srokov cherenkovaniya i reaktsii sredȳ na cherenki ivȳ pushistopobegovoy (*Salix dasyclados* Wimm.) [**Influence of the time of cutting and of the reaction of media upon Willow cuttings (*Salix dasyclados* Wimm.).**] *Sovetsk. Bot.* No. 3, 1944 (37–42). [Russ.] O.B.D. [598].

In leafless cuttings of *Salix dasyclados* taken during the period August–November both root and shoot growth was either absent or poor. Cuttings taken after November gave a higher percentage rooted with more roots per sample, and more intensive shoot growth. Cuttings placed in buffered phosphate solution with pH of 4·6–6 showed intensive root growth, whereas those in alkaline solution of pH 7–9·18 showed complete absence of root growth. Acidity of solution also affected shoot growth; of cuttings taken during the period October–January, those in solution with pH value of over 6 showed the most intensive shoot growth, while for cuttings taken after February, variation in pH value ceased to have any measurable effect.

12.11.22 : 12.26–8 : 12.11.15. OVERBEEK, J. VAN, and GREGORY, L. E. **A physiological separation of two factors necessary for the formation of roots on cuttings.** *Amer. J. Bot.* 32, 1945 (336–41). O.B.D. [599].

Experiments with a difficult-to-root, white-flowered, hybrid form of *Hibiscus*, which does not respond to regular auxin treatments, revealed that rooting takes place freely at the base of auxin-treated cuttings of this type provided that a shoot of the easy-rooting *Hibiscus rosa-sinensis* is grafted on to each one. Two factors appear to be necessary for successful rooting: (1) auxin, and (2) a factor or complex present in the leaves of the red-flowered species.

12.11.22 : 07.7 : 23.26.1. GROSSENBACHER, K. A. **An apparatus to maintain a surface**

film of water for use in vegetative propagation. *J. Arnold Arbor.* 26, 1945 (296–11). [600].

Description of a sprinkler system with automatic control mechanism developed and operated at the Harvard Forest in 1944 and designed to give maximum surface wetting to out-of-door propagating beds with a minimum amount of water, while allowing exposure of the beds to full sunlight. Cuttings of various forest trees were maintained in excellent condition. Satisfactory rooting was obtained with cuttings of Red Maple (*Acer rubrum*), Sugar Maple (*A. saccharum*) and Paper Birch (*Betula papyrifera*). During the relatively short 6–8 week period of the test, however, no satisfactory rooting was obtained with cuttings of Hemlock (*Tsuga canadensis*), Red Pine (*Pinus resinosa*), White Pine (*Pinus strobus*) or White Spruce (*Picea glauca*).

12.11.22 : 12.26–8 (82) : 44.3. Informase sobre algunas defectos atribuidos al álamo A.M. **[Some defects in the hybrid Poplar,'A.M.']** *Mundo maderero* 5 (57), 1944–45 (13). [Span.] [601].

A committee of the Argentine Forestry Department has investigated alleged defects in the hybrid Poplar 'A.M.', chiefly a tendency to medullary decay, and reports that this is caused by incorrect preparation of cuttings. The decay occurs when the cut is made in the middle of an internode instead of just above a bud.

12.11.22 : 12.25. Eames, A. J., and Cox, L. G. **A remarkable tree-fall and an unusual type of graft-union failure.** *Amer. J. Bot.* 32, 1945 (331–5). [Cornell Univ., Ithaca, New York.] O.B.D. [602].

Examination of the anatomical structure of a fallen 40-year-old grafted White Fir (*Abies concolor* L.) revealed that the fall was due to a break in tissues along a line of incomplete graft union. The margins of the cambium cylinders lay close together but remained unfused. Contact between the tracheids and sieve tubes of stock and scion was intimate, although lateral, but no parenchyma or 'wound tissue' was found between these cells. Graft-union failure of this type has not previously been reported.

12.11.23 : 12.26–8 : 12.14.2 : 21.23 (469. Azevedo Gomes, M., and Raposo, F. A formação do lenho do *Eucalyptus globulus* Labill. no região do Ribatejo. **[Formation of the wood of *Eucalyptus globulus* Labill. in the Ribatejo region.]** *Abstr.* in *Rev. agron. Lisboa* 30, 1942 (441–2). [Port.] E.M.B. [603].

The principal object of this article is to give an interpretation of wood formation in *Eucalyptus globulus* based on histological examination and to study the conditions necessary for the establishment of this exotic species in Portugal and the factors capable of affecting its growth. The species adapts itself with singular facility to a vast range of conditions.

12.11.23 : 12.26–8 : 21.9. Azevedo Gomes, M., and Raposo, F. A formação do lenho em árvores seculares. **[Wood formation in centuries-old trees.]** *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (441). [Port.] E.M.B. [604].

The two examples specially studied were specimens of *Erica arborea* (over 200 years old) and *Quercus suber* (approximately 100 years old).

12.11.23 : 11.11 : 07.7. Tint, H. **An apparatus for the growth of plants under controlled temperature levels.** *Phytopathology* 35, 1945 (511–6). [Univ. of Pennsylvania.] [605].

An apparatus is described, which permits the investigation of plant development simultaneously at several levels of temperature. The design of the equipment allows temperatures in separate compartments to fluctuate within their respective levels in a manner resembling the normal diurnal range of temperature in the field under the influence of varying degrees of insolation. Details for the construction of the equipment are given. The cost of the materials is relatively low and subsequent maintenance expenditures are negligible. *Author's summary.*

12.11.23 : 12.25–8 : 12.14.7 : 21.8. Johnson, L. P. V. **Development of sexual and vegetative organs on detached forest tree branches cultured in the greenhouse.** *For. Chron.* 21, 1945 (130–6). [National Research Council, Ottawa, Ont.] [606].

Experiments on the relation of nutrient solutions to development of seeds on detached branches of *Populus grandidentata* showed distilled water to be superior to solutions of Hoagland's, sucrose, or Hoagland's combined with sucrose, or to a peat humus infusion. Greenhouse conditions simulating out-door conditions in mid-May proved highly favourable to the development of flowers and seeds on detached branches of *Populus* and other forest trees cultured in water. Data are presented,

indicating the time at which various species of forest trees pass from a state of true dormancy to one of imposed dormancy (i.e. imposed by the unfavourable winter environment). For most species it appeared that this transition occurred between the middle of November and the first of December [at Ottawa]. Greenhouse phenological records showed that the time required for flower development decreases progressively from the onset of imposed dormancy. *Author's summary.*

12.11.3. *Heredity. Breeding. Races and Questions of Provenance. Cytology*

12.11.3 : 12.26–8 : 12.11.1 : 12.14. JOHNSSON, H. **The triploid progeny of the cross diploid × tetraploid *Populus tremula*.** *Hereditas, Lund* 31, 1945 (411–40). [Forest Tree Breeding Institute, Ekebo, Källstorp, Sweden.] K. [607].

An investigation was made on yearling plants of *Populus tremula* belonging to five diploid and five triploid cross-families with, in pairs, the same diploid mothers and diploid or tetraploid fathers.

The following properties were studied: leaf size, leaf thickness, stomatal length, number of stomata per leaf surface, length of wood cells, diameter of wood cells, growth in length, diameter and volume of stem, osmotic pressure, transpiration and assimilation intensity, dry-matter content of the leaves, volume weight and dry-matter content of the wood, and the cellulose, pentosan and lignin contents of the wood.

A primary effect of the polyploidy was increased cell size which was found in pollen grains, stomatal cells and the wood cells in the xylem.

Secondary effects of polyploidy, leaf gigantism, increased water content, and reduced volume weight were observed.

The polyploidy did not cause any gigantism in the stems of the young plants, although it is considered probable that such may appear in the older trees.

No specific influences from the polyploidy were detected on the physiological and chemical properties studied.

The results of the investigation are discussed, special stress being laid on the fact that there is no correlation between leaf thickness and growth of stem volume. *From author's summary.*

12.11.3 : 12.26–8. JOHNSSON, H. **Chromosome numbers of the progeny from the cross triploid × tetraploid *Populus tremula*.** *Hereditas, Lund* 31, 1945 (500–1). [Forest Tree Breeding Institute, Ekebo, Källstorp, Sweden.] K. [608].

Data are given based on chromosome counts on 200 plants from the triploid × tetraploid cross.

12.11.3 : 12.26–8 : 23.24. El cultivo del álamo A.M. **[The cultivation of the hybrid Poplar, 'A.M.']** *Mundo maderero* 5 (60), 1944–45 (3) [Span.] [609].

The hybrid Poplar 'A.M.' obtained in Italy in 1925 by Dr. Jacometti, is a cross between × *Populus canadensis* (female parent) and *P. nigra* var. 'Stella I' (male parent). A number of plants were brought from Italy in 1937 and planted in the Argentine National Nursery where they made remarkable growth (saplings of 5 months attain a height of 3·5 m.) and notable resistance to the 'Roya' disease which has ravaged the (mainly Italian) Poplar plantations in the Parana and other districts. Cuttings about 0·3 m. long are the best planting stock, but on sites very favourable to the growth of weeds, cuttings should be 0·6 m. long. Planting espacement should be 3 × 3 m. when the trees are being grown for timber and 2 × 2 m. in shelterbelts.

12.11.3 : 12.25–8. BOWDEN, W. M. **A list of chromosome numbers in higher plants. II. Menispermaceae to Verbenaceae.** *Amer. J. Bot.* 32, 1945 (191–201). [McMaster Univ., Hamilton, Ontario, Canada.] [610].

The present paper reports the chromosome numbers for numerous species and genera in nineteen families of angiosperms (including Moraceae, Oleaceae, Rhamnaceae, Rutaceae, Salicaceae, Sapindaceae, Tamaricaceae, Ulmaceae, Verbenaceae) and one family of gymnosperms (Pinaceae).

12.14. Organography. Morphology. Anatomy. Histology

12.14 : 12.26–8 : 34.26. BLASER, H. W. **Anatomy of *Cryptostegia grandiflora* with special reference to the latex system.** *Amer. J. Bot.* 32, 1945 (135–41). [Cornell Univ., Ithaca, N.Y.] O.B.D. [611].

12.14.3–5 : 12.26–8 : 12.14.7 : 09.2. BAILEY, I. W., and NAST, C. G. **Morphology and relationships of *Trochodendron* and**

***Tetracentron*. I. Stem, root and leaf. II. Inflorescence, flower, and fruit.** *J. Arnold Arbor.* 26, 1945 (143–54, 267–76 + plates). [Biological Laboratories, Harvard Univ.] [612].

These two papers deal largely with morphological features of *Trochodendron* and *Tetracentron* [cf. *For. Abstr.* 7 (Nos. 616, 667)] that have not previously been adequately covered in the literature. Owing to their retention of a primitive cambium and vesselless type of xylem, the two genera are important links in the history of angiosperm development. The morphology of stem, root and leaf is discussed and compared in the first paper under the headings: xylem, nodal anatomy and vascularization of the leaf; stomata; and palaeobotanical considerations.

The second paper deals with the morphology of the inflorescence, the floral organs and the fruit, and discusses the relationships of the two genera. Although they differ conspicuously in their habit of growth, in the form and vascularization of their leaves, and in the grosser characters of their inflorescences and flowers, they exhibit many peculiarities of internal structure, organization and development that are fundamentally similar. Whether they should be placed in a single family or in two separate but closely related monotypic families depends upon the taxonomic emphasis that is placed upon the obvious differences in their foliage, inflorescences and flowers.

12.14.4 : 12.25. Sterling, C. **Growth and vascular development in the shoot apex of *Sequoia sempervirens* (Lamb.) Endl. I. Structure and growth of the shoot apex.** *Amer. J. Bot.* 32, 1945 (118–26). [Univ. of California, Berkeley, Calif.] O.B.D. [613].

The apex of the leading shoot of *Sequoia sempervirens* has a ginkgoid zonation. Apical initials divide anticlinally and periclinally to produce a central mother cell zone, the cells of which are larger and more vacuolate, have thicker walls, and undergo fewer mitoses than the cells of the subjacent zone. This subjacent zone is composed of eumeristem cells which have arisen from the base and sides of the central mother cell zone by a renewal of mitotic activity. Pith mother cells differentiate from the eumeristem cells in the centre of the shoot. The level of appearance and extent of development of the rib-meristem in the pith appears to depend upon the state of activity of the apex.

In dormant shoots there is a prominent 'crown' of transversely expanded cells with thickened walls in the pith. This crown separates the apex from the rest of the shoot. There is no telescoping of the shoot of the following season in the dormant bud.

When the leaf primordium is but a few cells high, the future 'gap' area begins to develop adaxially to the procambial strand of the primordium. Although the foliar and bud primordia both are produced principally by subepidermal periclinal activity, the young bud maintains a hemispherical form in longisection in its early development while the nascent leaf develops a point apex when above five or six cells high. In transection, the bud primordium is shaped like a spindle, at each pole of which a prophyll arises. *Author's summary.*

12.14.4 : 12.26–8. Dormer, K. J. **An investigation of the taxonomic value of shoot structure in angiosperms with especial reference to Leguminosae.** *Ann. Bot.* (*n.s.*) 9, 1945 (141–53). O.B.D. [614].

It is found that phyllotaxy and the arrangement of the primary vascular system are of value in the taxonomic and phylogenetic treatment of the Leguminosae. Contrasting pairs of primitive and advanced features are set out in Table I, and examples are given to show how the evolution of these characters has been correlated, so that forms which are specialized in one respect are specialized also in others. The taxonomic value of phyllotaxy is shown to extend to many other angiosperm families.

It is suggested that the evolution of a typical herbaceous habit becomes possible only when the tangential continuity of the vascular system is maintained by nodal anastomoses between the bundles, so that there is no necessity for the formation of a continuous cylinder of secondary tissues. *From author's summary.*

12.14.5 : 12.25. Orr, M. Y. **The leaf anatomy of *Podocarpus*.** *Trans. bot. Soc. Edinb.* 34 (pt. 1), 1944 (1–54 + plates). O.B.D. [615].

A study of the leaf anatomy of a large number of *Podocarpus* spp. undertaken with the object of exploring the possibility of using the anatomical features of the foliage as an aid to the identification of species which exhibit similar external morphological features. The study was confined to the flat-leaved species comprising the sections *Stachycarpus*, *Eupodocarpus*, *Nageia* and *Polypodiopsis*, since the species included in *Dacrycarpus* and *Microcarpus* do not present the same difficulties in

identification. Although in some cases (e.g. most of the American species of *Eupodocarpus*) the structural differences are not sufficiently pronounced to be of value in species identification, nevertheless in the majority of the species examined the leaf anatomy does present some special features which are peculiar to individual species or groups of species and which are sufficiently stable to serve as criteria for distinguishing similar species in the same or other geographical areas.

12.14.5 : 12.26–8. FOSTER, A. S. **The foliar sclereids of *Trochodendron aralioides* Sieb. and Zucc.** *J. Arnold Arbor.* 26, 1945 (155–62 + plates). [Univ. of California, Berkeley.] [616].

A study of the form, structure, and distribution of sclereids in the petiole and lamina of the mature foliage leaf of *Trochodendron aralioides*. [Cf. *For. Abstr.* 7 (Nos. 612, 667).]

12.14.5 : 12.26–8. DEHAY, C. L'appareil libéro-ligneux foliare des Sterculiacées. [**The vascular system of the leaves of the Sterculiaceae.**] *Extr.* from *Ann. Sci. nat. (bot.)* 2, Ser. ii, 1940–41 (45–130 + [i]). [F.] [617].

After an introductory section dealing briefly with the position and delimitation of the Sterculiaceae, the floral characters and relative anatomy of the family, the use of anatomical characters in classification, the habitat of the Sterculiaceae, and terminology, the author reviews the vascular system of the leaf as seen in the various species of the Sterculiaceae proper and the sub-family Buettneriaceae.

12.14.5 : 12.26–8. WOLF, W. **Notes of foliar dimorphism in *Quercus nigra* L.** *Amer. Midl. Nat.* 33, 1945 (794). [St. Bernard College, St. Bernard, Ala.] [618].

Seedlings of the Water Oak (*Quercus nigra* L.) can be divided into two groups on the basis of leaf shape. One group has cuneate, cuneate-obovate or spatulate leaves, while the other has leaves which are linear-lanceolate, linear-elliptic or otherwise narrowly oblong in shape. Both types develop into normal Water Oaks. The author hopes that investigations will be made into the cause of the different shapes of the juvenile leaves.

12.14.6 : 12.25 : 12.11.14. CHELYADINOVA, A. I. Kolichestvo i kharakter razvitiya khvoi v sosnovom nasazhdenii. [**Amount and character of development of needles in Pine plantations.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 21, 1941 (30–50). [Russ.] [619].

Observations on the proportions of needles of different ages in a 14-year-old stand of *Pinus sylvestris* near Moscow made during the period July–September showed that July foliage is composed of 11–18 per cent. needles of the current year, 29–40 per cent. each of the 2nd and 3rd years, and 16–19 per cent. of the 4th year, whereas by September the proportions were 33 per cent. 1st year, 38 per cent. 2nd year, 23 per cent. 3rd year, and 6 per cent. 4th year. In both a 14-year and a 40-year-old stand the ratio of needle weight to branch weight decreases with the greater age of the branch and height of the crown. Height level in the crown is the determining factor in the development of the needles, which vary in size according to the intensity of light. Second-year needles in the crown of a 14-year-old Pine have smaller average areas than those of a 40-year-old Pine. The weight of foliage per tree is less in the average 14-year-old tree than in the 40-year-old but the weight per hectare is greater in the young crop, e.g. 9 tons of green foliage per ha. at 14 years old, 7·5 tons at 40. The total needle surface at 14 years is 4 times the ground area of the stand; at 40 years it is 2·5 times the ground area. Hence, owing to greater transpiration surface, a young Pine crop is likely to use more soil water than a middle-aged stand.

12.14.7 : 12.25. PAIS DO AMARAL FRANCO, J. M. A. Carpologia das coniferas. [**Carpology of conifers.**] *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (440–1). [Port.] E.M.B. [620].

The author stresses the necessity of creating new designations for coniferous fruits in accordance with their morphology and mode of evolution. There are two fundamental groups, based on the evolution of the carpellary scale. The first is characterized by the greater development of the seeds in relation to that of the scale; the second by the greater development of the scale. In the first case the seeds, either solitary or in bundles, are always free, with the scales reduced at the base, while in the second case the seeds are protected within an organ formed by the carpellary scales.

12.14.7 : 12.26–8 : 12.11.23. GUARD, A. T. **The development of the seed of *Liriodendron tulipifera* L.** *Proc. Indiana Acad. Sci.* 53, 1943 (75–7). [Purdue Univ.] L.S. [621].

An outline of the development of the seed of *Liriodendron tulipifera* from the time of flowering until maturity. In a very large number of the seeds examined there was no evidence of embryo and endosperm development, although the same rapid development of the integuments and nucellar tissue occurred as in seeds which developed embryo and endosperm. If competition for food is severe, this rapid development may possibly result in the starvation of the zygote. Self-pollination may also account for the failure of some of the seed to mature. Of approximately 800 seeds from cones self-pollinated by hand, only 11·7 per cent. showed filled seed, while cross-pollinated seed showed 38·9 per cent. of filled seed. The seed does not reach morphological maturity until between August 12th and September 15th.

12.14.8 : 12.25 (75.9). VALL, W. B. DE. **A bark character for the identification of certain Florida Pines.** *Proc. Fla. Acad. Sci. 1944*, 7, 1945 (101–3). L.S. [622].

The appearance of the cork cambium or phellogen layer has proved to be a useful diagnostic feature in the identification of native Florida Pines. The native species having ivory-white, conspicuous phellogen lines are *Pinus australis* Michx. f., *P. palustris* Mill., *P. echinata* Mill., *P. caribaea* Mor., *P. glabra* Walt., and *P. clausa* Englm. In the remaining two species (*P. taeda* L., and *P. serotina* Michx.) the lines are inconspicuous or, at most, slate-grey in colour. This bark character has been particularly useful for separating Loblolly Pine (*P. taeda*) from Swamp Pine (*P. palustris*) in the Gainesville area when other characters failed. A key to the species of native Florida Pines is appended.

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 : 12.26–8. MOLDENKE, H. N. **The known geographic distribution of the members of the Verbenaceae and Avicenniaceae.** Supplement 3. *Castanea* 10, 1945 (35–46). [New York Botanical Garden, New York.] [623].

12.19 : 11.12 : 11.14.6–7. HUFFAKER, C. B. **Vegetational correlations with vapor pressure deficit and relative humidity.** *Amer. Midl. Nat.* 28, 1942 (486–500). [Agricultural Exp. Sta., Newark, Delaware.] [624].

It is concluded from a discussion of the literature that vapour pressure deficit is a more critical ecological factor than relative humidity. The relation between vapour pressure deficit and the distribution of the major vegetational types is discussed.

12.19 (57) : 12.11.3. BOBROV, E. G. Ob osobennosti florȳ erraticheskoy oblasti. [**On peculiarities of the flora of the 'erratic region'.**] *Sovetsk. Bot.* No. 2, 1944 (3–20). [Russ.] O.B.D. [625].

Krashennikov's studies of the complex Siberian Pleistocene flora of the Southern Urals yielded schematic pictures of the distribution and floristic composition of Pre-Ural and Southern Ural vegetation in phases of the Pleistocene and Holocene periods. Kleopova analysed the history of broadleaved forests of the European U.S.S.R. from the beginning of the Pleistocene period and defined the influence of recurring glacial and interglacial periods. In northeastern Europe the floristic history of the whole area was governed by alternating glacial and interglacial periods and short climatic changes in postglacial times. Towards the end of the Pliocene the ranges of many species were reduced or split up. Some species isolated at the beginning of the Pleistocene continued to exist in localities sheltered from glacial conditions and became adapted to the diverging conditions of their several habitats. Widespread migrations occurred into ice-free territory from west to east and south, and also from the isolated habitats. As a result of converging migration over very long periods and on a vast territory open to all comers, hybridization was frequent and widespread. Examples of reciprocal hybridization as a result of migrational encounters in the Middle Volga region occur in *Primula officinalis*, *Pulsatilla patens*, *Rosa cinnamomea*, *Picea excelsa* [*P. abies*] and *Tilia septentrionalis*. Each of these species is discussed in detail and the author suggests that these forms should be recognized by binary nomenclature indicating geographical origin, thus the Spruce of the Middle Volga is not *Picea excelsa* Link, nor *Picea obovata* Ledb. but should be named × *Picea ruthenica*, n.sp.

12.19 (75.6). OOSTING, H. J. **An ecological analysis of the plant communities of Piedmont, North Carolina.** *Amer. Midl. Nat.* 28, 1942 (1–126). [Duke University, Durham, N.C.] [626].

An ecological analysis of the naturally-occurring plant communities of the North

Carolina Piedmont. The upland communities in this area have developed mainly on abandoned fields. By the third year *Andropogon* is dominant and maintains itself until it is shaded out by Pine (*Pinus taeda* or *P. echinata*) which frequently forms closed stands in 10–15 years. A 40-year-old Pine stand will have developed an understorey of subordinate hardwoods; by 70–80 years the Pine is overmature and, as it thins out, it is replaced by Oaks and Hickories which eventually (150–200 years) attain dominance. Lowland fields follow a similar pattern if well drained.

Secondary communities in bottomlands are variable in composition and dominance, but the final community is again Oak/Hickory.

Primary communities are restricted to isolated areas relatively inaccessible to man or valueless for cultivation. The commonest are on small islands and spits formed in streams where the pioneer species are Willow and Alder and where the succession later resembles the secondary lowland succession.

The climax of the region is Oak/Hickory, as indicated by relic stands and the gradual development of these hardwoods in the understorey of Pine stands. *From author's summary.*

12.19 (77.2) : 12.26–8 : 11.22. FRIESNER, R. C. **Correlation of microclimatic factors with species distribution in Shenk's woods, Howard County, Indiana.** *Abstr.* in *Proc. Indiana Acad. Sci.* 53, 1943 (72–3). [Butler Univ.] L.S. [627].

Shenk's Woods comprises two types of primeval forest—a *Quercus/Ulmus* type which occupies four-fifths of the entire area and an *Acer/Fagus* type occupying the remainder of the area. In the *Quercus/Ulmus* forest, four species of Oak (*Quercus borealis* var. *maxima*, *Q. bicolor*, *Q. macrocarpa* and *Q. muehlenbergii*) occupy 56·3 per cent. of the crown cover. *Ulmus americana* occupies 20·4, *Fraxinus americana* 6, *Acer saccharum* 4·95 and *Ulmus fulva* 5·95 per cent. In the smaller area *Acer saccharum* occupies 66·1, *Quercus* spp. 19·1, *Fagus grandifolia* 11·1, and *Ulmus fulva* 5·95 per cent. of the crown cover.

Evaporation studies showed very similar rates in the two areas. Study of edaphic factors showed that the moisture equivalent was higher in all horizons in the *Quercus/Ulmus* than in the *Acer/Fagus* area. In spite of the higher moisture equivalent the percentage of growth water in the soils was higher at all horizons in the *Quercus/Ulmus* area, and the differences were much accentuated during the critical weeks of July and August. Differences in the species occurring in the two areas is probably largely due to the differences in soil composition.

12.19 (43.6). MORTON, F. Die Pflanzengesellschaften des nördlichen Wienerwaldes. **[The plant communities of the northern Wienerwald.]** *Mitt. dtsch. dendrol. Ges.* 54, 1941 (15–43, 63–72). [G.] [Botanical Station, Hallstatt.] K. [628].

12.19 (51 : 57). VASIL'EV, V. N. O vzaimootnosheniyakh 'Manchzhurskoy' i 'Okhotskoy' rastitel'nosti i florȳ. **[On the relationship between the 'Manchurian' and 'Okhotsk' vegetation and flora.]** *Bot. Zh. SSSR.* 29, 1944 (161–70). [Russ.] O.B.D. [629].

Manchurian vegetation consists mainly of coniferous forest, with a predominance of *Pinus koraiensis* S. and Z. and *Abies holophylla* Max., with about 30 per cent. of broadleaved species. The richness of the vegetation, the palm-like habit of some species (e.g. *Kalopanax ricinifolium*, *Aralia mandshurica*), the number of lianes and the rich undergrowth, have led some scientists to include the Manchurian flora in the Sino-Japanese (Okhotsk) group. This is an error since the evergreen types so prevalent in the Okhotsk flora are almost completely lacking in the Manchurian, which much more resembles that of the temperate zone.

From the geological point of view, the Sino-Japanese (Okhotsk) forest region is one of the oldest parts of the earth, having been free from geological change for a very long time, so that the vegetation has been preserved and developed in an exceptional manner. Primitive species such as *Ginkgo* and *Liriodendron* are found there together with many species characteristic of a sub-tropical flora, such as species of *Zelkova*, *Celtis*, *Magnolia*, *Hamamelis*, *Diphylleia*, *Diospyros*, *Ilex*, *Castanea*, *Laurus*, *Periploca*, *Paliurus*, as well as *Citrus nobilis*, Evergreen Oak and many others. The vegetation of the Manchurian area, on the other hand, though not directly subjected to the influence of the quaternary glacial age, underwent peripheral pressure from it, with consequent impoverishment of the number of species and a large proportion of monotypic and oligotypic forms, resulting in a typical boreal flora with species of *Picea*, *Pinus*, *Abies*, *Juglans*, *Tilia*, *Acer*, *Fraxinus*, *Quercus*, *Corylus*, *Populus*, etc.

From these considerations it seems clear that Manchurian vegetation is distinct from Sino-Japanese, though elements from one group may penetrate the other.

There are, however, some associations of which it is difficult to decide to which groups they belong; such are the forests of *Populus maximowiczii* A. Henry and *Ulmus propinqua* Koidz. with rich herbaceous ground vegetation and little underwood, and Oak forest with underwood of *Lespedeza bicolor* Turcz. and *Corylus heterophylla* Fisch., to be found on the Pacific coast.

Some account is given of the interpenetration of Manchurian and Sino-Japanese floras and reasons given for thinking that both originated in the same centre of dispersal and that their differentiation is due to geological causes.

12.19.1. *Regional Floras, including Check Lists*

12.19.1 (51). METCALF, F. P. **Notes on the flora of Kung Ping Shan, Kwangtung.** *J. Arnold Arbor.* 26, 1945 (197–205). [Arnold Arboretum, Harvard Univ.] [630].

A list of plants collected in the extreme western part of Kwangtung Province, a few miles north of the Tonkin border, during July, August and September, 1936. Notes are included on 32 species reported from Kwangtung for the first time, about 20 of which are new also to China proper. Among the families represented are Moraceae, Magnoliaceae, Annonaceae, Flacourtiaceae, Ebenaceae, Verbenaceae and Rubiaceae.

12.19.1 (54.8) : 12.26–8 : 12.19.4 VENKATESHWARLU, V. **The estuarial flora of the Godavary.** *J. Bombay nat. Hist. Soc.* 44, 1944 (430–5). [Dept. of Botany, P.R. College, Cocanada.] K. [631].

The estuarial flora of the Godavary consists of a number of Mangroves with an undergrowth of perennial woody climbers, followed by the halophytes on the exposed mud-flats towards the land side. The pioneer species are *Avicennia alba* and *A. marina*, which pave the way for species of *Rhizophora*, *Bruguiera*, *Ceriops*, *Sonneratia*, etc. The species of *Lumnitzera*, *Aegiceras* and *Excoecaria* prefer shallower water towards the land side. Finally the bare and exposed sites are occupied by Chenopodiaceae. The undergrowth is composed of species of *Dalbergia*, *Caesalpinia*, *Derris* and *Sarcolobus*. The network of canals is lined by *Acanthus ilicifolius* and the tall grass *Myriostachya wightiana*. A systematic account is given of 26 species, including brief notes on their economic importance.

12.19.1 (56.9) : 12.25–8. NORRIS, F. H. **Some trees and plants in Palestine.** *J. R. hort. Soc.* 52, 1945 (197–200). O.B.D. [632].

A very general descriptive article dealing briefly with the vegetation of a small forestry reserve on the Jaffa-Jerusalem road.

12.19.1 (59.1 : 59.5 : 922) : 12.26–8 : 13.2. **Hints on living in the jungle, with information on useful and harmful plants of Burma, Malaya, Java, and Borneo.** With line drawings by Darnell, A. W. Biology War Committee [London]. [1945.] pp. 50. [633].

This small booklet gives information for the benefit of those working or fighting in tropical jungle, viz. sources of food from wild animals and fish, methods of cooking in bamboo or coconut pots, cleansing and disinfecting utensils, purification of water, etc. The cultivated and wild food plants are described in 35 full-page diagrams with characters for identification, and Burmese, Malay and Javanese vernacular names; 8 poisonous plants are similarly characterized. Other sections deal with scorpions, snakes, leeches, jellyfish, crocodiles, biting insects, mites and ticks, protective measures against biters and disease carriers (dimethyl phthalate as a repellent) and finally the treatment of malaria and dysentery.

12.19.1 (72) : 12.25 : 34.25 : 12.26–8. SCHULTES, R. E. **Plantae mexicanae X. New or critical species from Oaxaca.** *Bot. Mus. Leafl. Harv.* 9, 1941 (165–215). K. [634].

In the course of botanical and ethnobotanical studies made in the north-eastern districts of the State of Oaxaca, Mexico, a number of rare or undescribed plants were collected, some of which are of economic importance among the Indians of this region. Systematic descriptions of them are given. *Pinus strobus* L. var. *chiapensis* Martínez is very distinct from the other Pines of N.E. Oaxaca. It is tall and has a straight, smooth trunk lacking branches near the base, and grows in pure stands. *Phoebe chinantecorum* R. E. Schultes, sp. nov., is a small tree about 6 m. high; the Chinantec Indians use the fruit as food. *Ochroma pyramidale* (Cav.) Urban var. *concolor* (Rowlee) R. E. Schultes, comb. nov., is usually a much larger plant than *O. pyramidale*, and represents a distinct geographical variety centred in

southern Mexico and Guatemala. *Ardisia rekoi* Lundell, sp. nov., is a shrub or small tree with edible fruit. *Bumelia eloxochitlensis* R. E. Schultes & C. Conzatti, sp. nov., is a tree about 25 ft. high with spreading branches and edible fruit; its Spanish names are Tempiste and Zapotillobravo. *Faramea schultesii* Standley, sp. nov., is a shrub or small tree; the fruits are used medicinally by Indians.

12.19.1 (729.3) : 12.26–8. SCHIFFINO, J. Riqueza forestal dominicana. **[The forest wealth of the Dominican Republic.]** *Rev. Agric., S. Domingo* 35, 1944 (140–5). [Span.] L.S. [635].

The four species discussed briefly in this paper are *Roystonia regia* (H.B.K.) O. F. Cook (Palmaceae), *Phyllostylon brasiliensis* Capanema (Ulmaceae), *Comocladia dentata* Jacq. (Anacardiaceae), and *Jatropha curcas* L. (Euphorbiaceae). A list of vernacular names is given for each tree.

12.19.1 (74.1) : 12.25–8. ALLARD, H. A., and LEONARD, E. C. **Plants collected in the Lake Matagamon region, Piscataquis and Penobscot Counties, Maine.** *Castanea* 10, 1945 (13–30). [636].

An annotated list of plants collected in the vicinity of Lake Matagamon in July, 1939. The species are arranged more or less alphabetically under families. They include representatives of the genera *Juniperus*, *Pinus*, *Thuja*, *Populus*, *Salix*, *Alnus*, *Betula*, *Quercus*, and *Acer*.

12.19.1 (76.3). CORRELL, D. S., and CORRELL, H. B. **A collection of plants from Louisiana.** *Amer. Midl. Nat.* 26, 1941 (30–64). [Botanical Museum, Harvard Univ., Cambridge, Mass.] [637].

A list of plants collected in Louisiana during the period June 26th to August 24th, 1938, together with several additional collections of *Cyperus* made in Orleans Parish during September, 1937. It is not an exhaustive survey, but a number of the species collected are of particular interest because they represent range extensions or unusual distribution, or because they are rarely found in the State. The habitat of each species is indicated.

12.19.1 (78.2) : 12.26–8. TOLSTEAD, W. L. **New and noteworthy records of the flora of Nebraska.** *Amer. Midl. Nat.* 28, 1942 (482–5). [Univ. of Nebraska, Lincoln, Nebr.] [638].

Among the species not previously recorded from Nebraska is *Salix exigua* var. *luteosericea* from sand-hill meadows in Cherry County.

12.19.1 (78.9 : 79.1) : 12.26–8. TIDESTROM, I., and KITTEL, T. **The flora of Arizona and New Mexico.** Catholic University of America Press, Washington. 1940. pp. 750 + map. Price $4.50. Biol. Abstr. 19 (14019). [639].

The main text treats of the vascular plants of Arizona and New Mexico, giving keys to all categories, and synonymy, habitat, and general distribution for each species. Among the species and varieties not credited to previous places of publication are *Pinus monophylla* var. *tenuis*, *Cercis occidentalis* var. *orbiculata* (*C. orbiculata* Greene), and *Cassia rostrata* (*Chamaecrista rostrata* W. & S.).

12.19.1 (485) : 12.2. URSING, B. Svenska växter i text och bild. **[Swedish plants in text and picture.]** Nordisk Rotogravyr, Stockholm. 1944. pp. 398. [Sw.] [640].

A popular flora, with keys for determination, and coloured illustrations of all the common plants of Sweden.

12.19.1 (79.4). COOKE, W. B. **First supplement to the flora of Mount Shasta.** *Amer. Midl. Nat.* 26, 1941 (74–84). [641].

An extension of range has been recorded for many species, and 1 family, 21 genera and 62 species are added to the author's original list [cf. *For. Abstr.* 3 (32)]. Notes are given on early collections in the Mount Shasta area and on type specimens reported to have been collected there.

12.19.1 (86) : 12.26–8 : 34.26. SCHULTES, R. E. **Plantae colombianae, IX.** *Caldasia* 3, 1944 (121–30). [E.] [Harvard Botanical Museum, Cambridge, Mass.] K. [642].

The material discussed in this paper was collected during explorations in the upper Apaporis River Basin of eastern Colombia for the purpose of making a study of *Hevea* and other commercially valuable laticiferous plants and the possibilities of their exploitation. A new woody species, *Senefeldera chiribiquetensis* R. E. Schultes & L. Croizat, is described. Analyses of the dried leaves, stems and bark of a complete plant of this species from the type locality showed a benzol-extracted rubber content of 0·56, 0·44, and 0·76 per cent. respectively. The quality of rubber extracted from the leaves and stems was fair, while that from the bark was of good quality.

Notes are added on the plant ecology of some isolated sandstone hills of the Vaupés region.

12.19.1–2 (75.5). FERNALD, M. L. **Botanical specialities of the Seward Forest and adjacent areas of Southeastern Virginia.** *Rhodora* 47, 1945 (93–142, 149–82, 191–204 + plates). O.B.D. [643].

The main part of this work consists of an annotated list of the vascular plants collected during two visits to the Seward Forest in June and September 1944. Extensions of range are recorded for *Magnolia virginiana* L. var. *australis* Sarg. and *Fraxinus caroliniana* Mill. var. *pubescens* (M. A. Curtis) Fernald, and notes are given on the nomenclature of *Ulmus rubra* Muehl. and on the identity of *Acer barbatum* Michaux.

12.19.4. *Succession*

12.19.4 (75.9). KURZ, H. **Secondary forest succession in the Tallahassee red hills.** *Proc. Fla. Acad. Sci. 1944.*, 7, 1945(59–100 + plate). L.S. [644].

Secondary succession in unburned situations in the Tallahassee red hills proceeds rather rapidly through five associations or stages, each of which is discussed: (1) the annual/biennial ruderal, (2) the perennial dog-fennel/broom-sedge, (3) the Shortleaf Pine, (4) the Pine/Oak/Hickory, and (5) the final Magnolia/Beech climax. The chief species present in the Pine/Oak/Hickory stage are *Pinus echinata*, *Quercus rubra*, *Q. laurifolia*, *Q. nigra* and *Hicoria alba* [= *Carya tomentosa*]. The climax vegetation consists mainly of *Magnolia grandiflora* and *Fagus grandifolia*. A table is included showing the floristic composition of associations and successions of individual species. Plant successions on burned areas are also indicated.

12.19.4 (76.3). BONCK, J., and PENFOUND, W. T. **Plant succession on abandoned farm land in the vicinity of New Orleans, Louisiana.** *Amer. Midl. Nat.* 33, 1945 (520–9). [Loyola Univ., New Orleans, Louisiana.] [645].

Plant succession on abandoned sugar-cane plantations along the Mississippi River near New Orleans was marked by three stages: annual-weed stage, perennial-weed stage, and shrub stage. From the second year onwards the number and density of the shrub flora increased, until about the tenth year when the shrub stage had become fully established. In a 25-year-old stand Wax Myrtle, the predominant species, formed a dense canopy, but the presence of numerous seedlings of Live Oak (*Quercus virginiana*) suggested that the shrub community would eventually give way to evergreen Oak forest in which Live Oak would be the most important component.

12.2. *Special [Systematic] Botany*

12.21. Fungi

12.21 : 44.3 : 12.25. SKOLKO, A. J. **A cultural and cytological investigation of a two-spored Basidiomycete, *Aleurodiscus canadensis* n.sp.** *Canad. J. Res.* 22, 1944 (251–71). P.R. [646].

A study of *Aleurodiscus canadensis*, n.sp., a fungus first discovered on branches of *Picea canadensis* in late June, 1938, and since found to be quite common in parts of Ontario and Quebec. The new species is described and discussed, and an outline is given of its normal life cycle on the basis of cultural and cytological evidence.

12.21 (469) : 44.3. LOPES, J. P. Contribuïção para o estudo dos Basidiomicetas portugueses. III. **[Contribution to the study of Portuguese Basidiomycetes. III.]** *Brotéria* 14, 1945 (5–13 + plate). [Port.] I.I.E. [647].

Includes *Polyporus betulinus* (Bull.) Fr. on trunks of *Betula* spp.; *Lenzites betulina* (L.) Fr. on dry trunks of *Eucalyptus*; *Pholiota cylindracea* (D.C.) Gill on roots of *Salix babylonica*; and various fungi found in Pine forests. *P. betulinus* is a species new to Portugal.

12.21 (469) : 44.3. REZENDE-PINTO, M. C. DE Hymeniales de Portugal. **[Portuguese Hymeniales.]** *Brotéria* 14, 1945 (26–42). [Port.] I.I.E. [648].

An annotated list of fungi of the genera *Polyporus*, *Polystictus*, *Poria*, *Porothelium*, *Solenia*, *Suillus* [*Boletus*], *Trametes* and *Tylopilus* found in Portugal. Many of the species listed attack trees.

12.21 (47) : 11.43.1. VASIL'KOV, B. P. K sistematike osinovika—*Boletus versipellis* Fr. **[On the systematics of the Aspen fungus *Boletus versipellis* Fr.]** *Sovetsk. Bot.* No. 2, 1944 (21–7). [Russ.] O.B.D. [649].

B. versipellis Fr. is considered to include as mycorrhizal forms: (1) f. *aurantiacus* (Bull.), growing in symbiotic association with Aspen; (2) f. *rufescens* (Secr. ex Konr.), with Birch; (3) f. *ericetorum* Vasil'kov, with Pine in the

Pinetum callunosum type; (4) f. *arcticus* (Lebed.), with Dwarf Birch.

There is also a description of *B.* (*Krombholzia*) *percandidus* Vasil'kov sp. nov. from Pine/Birch forest with *Molinia* and some *Populus tremula* in the Middle Volga region.

12.21 (51). WEI FAN CHIU. **The Russulaceae of Yunnan.** *Lloydia* 8, 1945 (31–59). P.R. [650].

Descriptions of thirty-one species of *Russula* and nineteen species of *Lactarius* found in Yunnan. Three species of *Russula* and five of *Lactarius* are claimed to be new species. They were found mostly under stands of *Pinus yunnanensis* and *Quercus* spp., and in mixed woods.

12.21 (67.6) : 12.25 : 12.26–8. HANSFORD, C. G. **Host list of the parasitic fungi of Uganda.** *E. Afr. agric. J.* 8, 1942–43 (248–52); 9, 1943–44 (50–5, 102–6). [Uganda Department of Agriculture.] [651].

This list replaces that published in the same journal in 1937–38. Since then, revision of many species has become necessary and new species have been added. In the present list the names of the fungi are arranged according to their hosts under the main headings: algae; fungi; gymnospermae; dicotyledones; and fungi parasitic on animals.

12.25. Gymnosperms

12.25 (494) : 12.19. HESS, E. Die Verbreitung der Lärche in der Schweiz. [**The distribution of Larch in Switzerland.**] *Schweiz. Z. Forstw.* 93, 1942 (232–4). [G.] [652].

Larch is found chiefly in the Cantons of Valais, Grisons, and Ticino, in which it forms 26 per cent., 12 per cent. and 20 per cent. respectively of the total growing stock. Only under optimum conditions does it occur in pure stands. It grows most frequently in mixture with Spruce.

12.25 (87). SCHNEE, L. El genero *Podocarpus* en Venezuela. [**The genus *Podocarpus* in Venezuela.**] *Bol. Soc. venez. Cienc. nat.* 9, 1944 (181–8 + plates). [Span.] I.I.E. [653].

Podocarpus is the only genus of conifers which occurs naturally in Venezuela. The author gives a brief key to the six Venezuelan species—*P. rospigliosii*, *P. montanus*, *P. harmsianus*, *P. macrostachyus*, *P. roraimae*, and *P. coriaceus*. Each species is described and illustrated by drawings, and notes are given on its distribution, synonymy, collections in Venezuelan herbaria, and on the material examined. All the Venezuelan species of *Podocarpus* are dioecious.

12.25–8 (410) : 12.14.4–5. MAKINS, F. K. **British trees in winter.** J. M. Dent and Sons, Ltd., London. 1945. pp. 56. Price 7*s.* 6*d.* [654].

This book makes it possible to identify the commoner evergreen and deciduous trees in winter. Short descriptions are given in an alphabetical list under common and botanical names, and the list is supplemented by a key to the characters of twigs illustrated by 40 diagrams, and by 48 photographs of tree form and bark.

12.26-8. Dicotyledons

12.26–8 : 12.11.3. JAHN. Genetische Studien an Bäumen. 2. *Acer platanoides* var. *integrilobium* Zabel. [**Genetical studies on trees: 2. *Acer platanoides* var. *integrilobium* Zabel.**] *Mitt. dtsch. dendrol. Ges.* 54, 1941 (54–7). [G.] K. [655].

Acer platanoides var. *integrilobium* has been held to be a hybrid of *A. platanoides* × *A. cappadocicum* or of *A. platanoides* × *A. lobelii*, but the writer of this paper gives reasons for regarding it as a variety of *A. platanoides* and not a hybrid at all.

12.26–8. BARKLEY, F. A. **A key to the genera of the Anacardiaceae.** *Amer. Midl. Nat.* 28, 1942 (465–74). [Montana State Univ., Missoula.] [656].

A table of synonymy and index of accepted genera is appended to the 8-page annotated key to the genera.

12.26–8. FRIES, R. E. Einige Gesichtspunkte zur systematischen Gruppierung der amerikanischen Annonaceen-Gattungen. [**Some points of view on the systematic grouping of the American genera of the Annonaceae.**] *Arkiv. Bot.* 30A (8), 1943 (1–31). [G.] Biol. Abstr. 19 (7132). [657].

The author gives a general taxonomic survey of the Custard-apple family. He recognizes 10 genera: *Asimina*, *Crematosperma*, *Guatteria*, *Unonopsis*, *Xylopia*, *Sapranthus*, *Porcelia*, *Duguetia*, *Annona*, and *Tetrameranthus*.

12.26–8. FOSBERG, F. R. **The genus *Batocarpus* Karst. (Moraceae).** *Proc. biol. Soc. Wash.* 55, 1942 (99–102). [Bureau of Plant Industry, Washington, D.C.] N.H.M. [658].

The writer proposes to combine the genera

Anonocarpus and *Batocarpus*, each containing a single species, under the older name *Batocarpus* Karst. The names proposed for the two species are *B. orinocensis* and *B. amazonicus*. The differences between this genus and the closely related *Sahagunia* Liebn. are detailed.

12.26–8 : 31.0 : 33. GALINDO, A. R. Abarco. [***Cariniana pyriformis* Miers.**] *Agricultura, Bogotá* 16, 1944 (1201–2). [Span.] (*Agric. Ganad. Bogotá*, No. 10.) C.G.B. [659].

Notes on *Cariniana pyriformis* under the headings, (*a*) vernacular name, (*b*) botanical name, (*c*) family, (*d*) distribution, (*e*) qualities of the timber, (*f*) industrial uses, (*g*) botanical characters, and (*h*) mechanical coefficients.

12.26–8. SHERFF, E. E. **Some additions to the genus *Dodonaea* L. (Fam. Sapindaceae).** *Amer. J. Bot.* 32, 1945 (202–14). [Chicago Teachers College, Chicago, Ill.] O.B.D. [660].

Twenty-nine new species, varieties, forms or combinations of *Dodonaea* are listed, including the shrubby trees *D. sandwicensis*, sp. nov., (2–6 m.) and *D. eriocarpus* var. *hosakana*, var. nov., (about 2·4 m. high).

12.26–8. REHDER, A. **Moraceae, Hippocastanaceae et Vitaceae, nomina conservanda.** *J. Arnold Arbor.* 26, 1945 (277–9). [Arnold Arboretum, Harvard Univ.] [661].

The three names proposed for conservation [(1) Moraceae *Lindley* (= *Artocarpaceae* Horaninov), (2) Hippocastanaceae *Torrey and Gray* (*Paviaceae* Horaninov), and (3) Vitaceae *Lindley* (*Leeaceae* Horaninov)] have been generally accepted by recent authors and would be the correct names for the three families if each of them were not antedated by an older validly published and correctly formed name. The reasons for conserving the later names are briefly outlined.

12.26–8. HARPER, F. ***Quercus incana* Bartram.** *Bartonia* No. 22, 1943 (3). K. [662].

Lack of an index to William Bartram's *Travels* (1791) has militated against the recognition of all the available plant names that it contains. One of his overlooked species is '*Q*[*uercus*] *incana, foliis ovalibus integerrimis subtus incanis*'. This applies unmistakably to the Upland Willow Oak, currently known as *Q. cinerea* Michx. Consequently Bartram's name must replace Michaux's. *Q. incana* Bartram preoccupies *Q. incana* Roxburgh (*Hortus Bengalensis* 1814), which was suggested for an Indian Oak.

12.26–8. JONES, G. N. ***Sorbus andersoni*, a new name for an Alaskan Mountain-Ash.** *Rhodora* 47, 1945 (220). [663].

Since the name *Sorbus alaskana* given by the writer to the Alaskan Mountain Ash in 1939 had been previously used in naming a fossil species, the new name *Sorbus andersoni* is proposed for the living species.

12.26–8 (43.1–5) : 21 : 57 : 52.43.3. ZIMMERLE, H. Beiträge zur Biologie der Esche in Württemberg. [**Contributions to the biology of the Ash in Württemberg.**] *Allg. Forst- u. Jagdztg.* 118, 1942 (245–55, 273–83, 308–18). [G.] [664].

The author discusses the silvicultural characteristics and yield of Ash in pure and in mixed stands in Württemberg, the establishment of a volume table for Ash cordwood over 7 cm. in diameter (Derbholz) and investigations on the stem form of Ash.

12.26–8 (5) : 12.19. BARNETT, E. C. **Keys to the species groups of *Quercus*, *Lithocarpus* and *Castanopsis* of Eastern Asia, with notes on their distribution.** *Trans. bot. Soc. Edinb.* 34 (pt. 1), 1944 (159–204). O.B.D. [665].

The three genera of Oak, *Quercus* Linn., *Lithocarpus* Blume, and *Castanopsis* Spach., are represented in Eastern Asia by 485 species, *Quercus* with 145, *Lithocarpus* with 221, and *Castanopsis* with 119 species.

The genus *Quercus* is divided, according to the arrangement of cupular scales, into two sections, *Lepidobalanus* and *Cyclobalanopsis*. These sections are further divided into species groups, the former into 8, the latter into seven groups. The genus *Lithocarpus* is divided by the form of the fruit into five sections, *Pasania*, *Cyclobalanus*, *Chlamydobalanus*, *Synaedrys*, and *Corylopasania*. Of these *Chlamydobalanus* and *Corylopasania* are small sections with sixteen and three species respectively. *Pasania*, by far the largest section with 108 species, is further divided into 12 species groups, *Cyclobalanus*, with 29 species, into three groups, and *Synaedrys*, with 34 species, into 4 groups. The genus *Castanopsis* is divided into 11 species groups.

For purposes of distribution Eastern Asia is divided into four main regions. These are referred to as the Indo-Burmese, Chinese, French Indo-Chinese, and Malayan regions. Notes on the distribution of the species groups

are given and a detailed distribution of individual species is shown in the accompanying tables.

While each of the 3 genera is represented in all the 4 regions, the distribution of the genera is quite distinct. The genus *Quercus*, unlike the other genera, is not wholly Asiatic. The section *Lepidobalanus*, comprising a large number of species, is largely American. It is represented in Asia by comparatively few species and is absent from the Malayan region. The Asiatic species of the genus are found mainly in northern regions, with the Chinese region as the main centre. A true Malayan element is probably represented by 5 species of the *Q. oidocarpa* group. The number of species in Malaya is increased by some Indo-Burmese species which have migrated southwards. The relationship between the genera *Lithocarpus* and *Castanopsis* is much closer than that between either of them and *Quercus*. In geographical distribution also these two genera resemble each other. The Malayan and French Indo-Chinese regions are richest in species of *Lithocarpus*, while species of *Castanopsis* are more evenly distributed in the French Indo-Chinese, Chinese and Malayan regions. Both genera are poorly represented in the Burmese regions.

The floras of the 3 northern regions (Indo-Burmese, Chinese, and French Indo-Chinese) are closely related, many of the species being common to all three. The Malayan flora is much more distinctive. Many of the species belong to groups not represented in other regions. It has been enriched by plants from other regions, the Indo-Burmese in particular. True Malayan species do not occur further north than Lower Burma and Peninsular Thailand. *Author's summary.*

12.26–8 (51). MERRILL, E. D. **Two new species from the vicinity of Hongkong.** *J. Arnold Arbor.* 26, 1945 (163–7). [Arnold Arboretum, Harvard Univ.] [666].

The two new species described in this paper are *Maackia ellipticocarpa* (Leguminosae), a shrub about 2 m. high, and *Diospyros taamii* (Ebenaceae), a small tree about 7 m. high. The species *Euphorbia macrorhiza* is recorded in China for the first time.

12.26–8 (51 : 52). SMITH, A. C. **A taxonomic review of *Trochodendron* and *Tetracentron*.** *J. Arnold Arbor.* 26, 1945 (123–42). **[Arnold Arboretum, Harvard Univ.] [667].**

The present paper is planned to re-describe the monotypic genera *Trochodendron* and *Tetracentron*, to give reasonably full citations to the literature pertaining to these genera, to list the specimens available in the larger American herbaria, and briefly to discuss the inter-relationships of the two groups [cf. *For. Abstr.* 7 (Nos. 612, 616)]. *Author's summary.*

12.26–8 (54.6) : 12.19 : 2 : 12.14.5. DHARESHWAR, S. S. **Occurrence of *Hopea parviflora* in Honavar Range, Bombay Province.** *Indian For.* 66, 1940 (436–9). [668].

A report of the occurrence of *Hopea parviflora* in Bombay Province, with a description of the leaf, and notes on the habitat, silvicultural characters and natural and artificial regeneration of the species and on the silvicultural treatment proposed.

12.26–8 (67.5) : 12.19 : 31.1–2 : 33.0. LOUIS, J., and FOUARGE, J. Essences forestières et bois du Congo. Fascicule 2. *Afrormosia elata.* **[Forest tree species and timbers of the Congo. Fascicle 2. *Afrormosia elata.*]** Institut National pour l'Étude Agronomique du Congo Belge, Bruxelles. 1943. pp. 22 + plates. [F.] Essences forestières et bois du Congo. Fascicule 3. *Guarea thompsoni.* **[Forest tree species and timbers of the Congo. Fascicle 3. *Guarea thompsoni.*]** Institute National pour l'Étude Agronomique du Congo Belge, Bruxelles. 1944. pp. 38 + plates. [F.] [669].

Detailed studies of *Afrormosia elata* (Leguminosae-Papilionatae) and *Guarea thompsoni* (Meliaceae) under the headings:—A. Botanical and forest characters: (1) essential considerations with respect to the genus; (2) salient features of the species; (3) botanical description; (4) habitat, ecology and phenology; (5) geographical distribution; (6) vernacular names; (7) information from the point of view of forestry. B. Characteristics of the timber: (1) commercial names; (2) description of the wood and its anatomical characters; (3) physical characters; (4) mechanical characters; (5) technological characters; (6) susceptibility to wood-destroying insects after cutting; (7) uses.

12.26–8 (67.5). LOUIS, J. Contribution à l'étude du genre *Afrormosia* au Congo Belge. **[Contribution to the study of the genus *Afrormosia* in the Belgian Congo.]** *Extr.* from *Bull. Jard. bot. Brux.* 17, 1943 (109–16). [F.] [Institut Agronomique de L'État, Gembleux.] [670].

Six species and one variety of the exclusively African genus *Afrormosia* have been described previously. They are: *A. laxiflora* (Benth.) Harms, *A. angolensis* (Bak.) Harms, *A. brasseuriana* (De Wild.) Harms, *A. elata* Harms, *A. bequaerti* De Wild., *A. brasseuriana* (De Wild.) Harms var. *subtomentosa* De Wild. and *A. schliebenii* Harms. In this paper a key is given to the Congo species and varieties of this genus: *A. angolensis*, *A. angolensis* var. *subtomentosa*, *A. angolensis* var. *brasseuriana* and *A. elata*. References to literature, vernacular names, and habitat are indicated for each species or variety.

12.26–8 (7–8). CROIZAT, L. **New or critical Euphorbiaceae from the Americas.** *J. Arnold Arbor.* 26, 1945 (181–96 + plate). [Arnold Arboretum, Harvard Univ.] [671].

Descriptions are given of various new species and varieties, including the trees *Croton pyriticus* (20 m.) and *Cunuria* (?) *casiquiarensis* (6 m.), and a new genus of shrubs and small trees from Cuba, *Moacroton*. Critical notes and records are included and reductions and transfers of species are indicated.

12.26–8 (7 : 8). MCVAUGH, R. **The genus *Jatropha* in America: principal intrageneric groups.** *Bull. Torrey bot. Cl.* 72, 1945 (271–94). [U.S. Bureau of Plant Industry Station, Beltsville, Md.] O.B.D. [672].

An attempt is made to set forth the principal lines of divergence within the genus *Jatropha* in America. The author reviews the earlier classifications of the genus by Mueller (1866) and Pax (1910) and himself suggests its division into four more or less homogeneous groups—Sect. *Polymorphae* Pax, Sect. *Macranthae* Pax, Sect. *Adenorhopium* Giseb., and Sect. *Mozinna* (Ortiga) Pax, each of which is described and discussed.

An index to the American species of *Jatropha* is appended.

12.26–8 (71.2–4 : 71.9) : 12.19. RAUP, H. M. **The willows of the Hudson Bay Regions and the Labrador Peninsula.** *Sargentia* 4, 1943 (81–127). K. [673].

This paper is based on a study of collections made in several expeditions in 1939, and comparison with some 1,700 specimens in herbaria. It contains very little in the way of taxonomic innovation and no new species, varieties or forms. Its main object is to record for the first time in one place a large mass of new information about the Willows of the Hudson Bay and Labrador regions. The immediate results have been the clarification of some of the more poorly known species and a greatly increased knowledge of the geographic aspects of the genus in N.E. America. Diagnostic keys, and diagrams showing distribution of 60 species are given.

12.26–8 (72). LUNDELL, C. L. **The genus *Cnidoscolus* in Mexico: new species and critical notes.** *Bull. Torrey bot. Cl.* 72, 1945 (319–34). [Institute of Technology and Plant Industry, Southern Methodist Univ., Dallas, Tex.] O.B.D. [674].

Among the new species described is *Cnidoscolus spinosus* Lundell, an arborescent shrub or small tree up to 5 m. collected along the seashore at Chimo, Municipio Puerto Vallarta, Jalisco, Mexico.

12.26–8 (72 : 728). ALLEN, C. K. **Studies in the Lauraceae, VI. Preliminary survey of the Mexican and Central American species.** *J. Arnold Arbor.* 26, 1945 (280–364). [675].

Keys to the Mexican and Central American genera of the Lauraceae and to the species of *Persea*, *Phoebe* and *Ocotea* are included in part VI. Among the plants listed and botanically described are the following new species of trees: *Persea steyermarkii*, *P. rigens*, *P. skutchii*, *P. hintonii*, *Phoebe arsenei*, *P. smithii*, *Ocotea cooperi*, *O. seibertii*, *O. wedeliana*, *O. paulii*, *O. austinii*, *O. skutchii*, and *O. meziana*. Synonymy, native names, and distribution are given wherever applicable, and characteristic features and species relationships are indicated. Species and varieties excluded from each of the genera are listed separately.

12.26–8 (729) : 23.2 : 23.5. WADSWORTH, F. H. **Further notes on the regeneration and growth of *Tabebuia pallida* Miers.** *Carib. For.* 6, 1944–45 (267–72). [E.Span.f.] [Tropical Forest Exp. Sta., Puerto Rico.] [676].

In a previous article [cf. *For. Abstr.* 5 (23)] the potentialities of Roble (*Tabebuia pallida*) for establishing a forest cover on difficult sites were described. Recent observation and study in Puerto Rico have brought to light additional information regarding this tree, and have confirmed the fact that Roble wildings can be easily established and can compete successfully with herbaceous vegetation during the first two years after planting. The growth of this species is not very rapid, best results being obtained in stands kept open by frequent

thinnings. It is one of the best species for establishing a forest cover on open, grassy degraded sites, and provides a favourable environment for the later invasion and establishment of the more shade-tolerant species.

12.26–8 (729.1) : 23.27. PONCE DE LEÓN, A Joyas de la flora cubana: el roble blanco (*Tabebuia pentaphylla* Hemsl.). **[Gems of the Cuban flora: The White Oak (*Tabebuia pentaphylla* Hemsl.).]** *Rev. Soc. cubana Bot.* 1 (1), 1944 (18–9). [Span.] K. [677].

A brief note accompanied by a photographic illustration emphasizing the advantages of *Tabebuia pentaphylla* as an ornamental and as a timber tree.

12.26–8 (73) : 23.27. SCANLON, E. H. **Rare Yellow Magnolia recorded.** *Trees, Sta. Monica* 6 (3), 1945 (12). [678].

Reference is made to existing specimens of *Magnolia cordata* Michx., a native of Georgia and S. Carolina, which, it is suggested, might be used as an ornamental tree over a much wider area.

12.26–8 (73). PALMER, E. J. ***Quercus prinus* Linnaeus.** *Amer. Midl. Nat.* 29, 1943 (783–4). [Arnold Arboretum, Jamaica Plain, Mass.] [679].

A distinction is drawn between *Quercus prinus* L., a tree of the coastal plain and of the southern lowlands, and *Quercus montana* Willd., the Chestnut Oak of the northeastern United States. The synonymy of *Q. prinus* is as follows: *Q. prinus* (*palustris*) Michaux, *Q. michauxii* Nuttall, *Q. prinus* var. *michauxii* Chapman, and *Q. houstoniana* Muller.

12.26–8 (75.4). AMMONS, N., and CORE, E. L. **The Hollies of West Virginia.** *Castanea* 10, 1945 (57–60). [West Virginia University, Morgantown, West Virginia.] [680].

Characters and a key to the five species *Nemopanthus mucronata, Ilex opaca, I. collina, I. montana* and *I. verticillata.*

12.26–8 (75.8 : 76.1–5). PALMER, E. J. ***Quercus durandii* and its allies.** *Amer. Midl. Nat.* 33, 1945 (514–9). [Arnold Arboretum, Jamaica Plain, Mass.] [681].

A discussion on the comparatively rare White Oak, *Quercus durandii*, from the Gulf coastal plain, and some closely related species or varieties, including *Q. durandii* var. *breviloba*, comb. nov., *Q. durandii* var. *austrina*, comb. nov., and *Q. laceyi.* A brief key is appended.

12.26–8 (79.4) : 12.11.3. WOLF, C. B. **The Gander Oak, a new hybrid Oak from San Diego County, California.** *Repr.* from *Proc. Calif. Acad. Sci.* (*4th Ser.*) 25 (5), 1944 (177–87). [Rancho Santa Ana Botanic Garden.] L.S. [682].

The new Oak, × *Quercus ganderi* C. B. Wolf, hybr. nov., which is a cross between *Quercus kelloggii* Newb. and *Q. agrifolia* var. *oxyadenia* (Torr.) J. T. Howell, is described, and a statement is given of all the localities and specimens examined. It may eventually prove of some value for horticulture as it possesses many of the fine features of *Quercus kellogii* plus semi-evergreen foliage, a vigorous rate of growth, and hardiness at low elevations.

12.26–8 (82) : 12.19. CASTELLANOS, A. Contribución a la flora de San Luis. II. El Guayacán del Bajo de los Vélez. **[Contribution to the flora of San Luis. II. The Guayacán of the Vélez Basin.]** *Lilloa* 10, 1944 (433–44 + plate). [Span.] A.P.B. [683].

Caesalpinia melanocarpa occurs sporadically in the north of the Province of San Luis. The author discusses the species and its place in the Argentine flora and cites records of its distribution.

12.26–8 (82) : 31.0 : 34.24–5. ALFONSO, J. L. El quebracho blanco. **[*Aspidosperma quebracho-blanco* Schl.]** *Mundo maderero* 5 (60), 1944–45 (12–4). [Span.] [684].

This article, which is an excerpt from a book on Argentine indigenous trees (*Forestales indígenes de la Argentina*), gives a general account of the species *Aspidosperma quebracho-blanco*, methods of propagation, wood properties and chemistry, and utilization. The wood is chiefly used for the manufacture of charcoal. The bark, which is used for tanning and also provides a valuable febrifuge, contains from 0·3 to 1·4 per cent. of alkaloids (quebrachina, aspidospermina, quebrachamina, aspidosamina, aspidospermatina and hypequebrachina).

12.26–8 (82). LEGRAND, D. Contribución al conocimiento de tres arboles argentinos de la familia de las Mirtaceas. **[Contribution to the knowledge of three Argentine trees of the Myrtaceae.]** *Lilloa* 10, 1944 (471–82 + plate). [Span.] A.P.B. [685].

The three species described are *Eugenia mato* Griseb., *E. pseudo-mato*, sp. nov., and *Myrtus güili* (Speg.) Legrand (= *E. güili* Speg.). The new species is reported from Tucumán.

12.26–8 (82). CASTELLANOS, A. La especie de *Ficus* del noroeste argentino. **[The *Ficus* species of northwest Argentina.]** *Lilloa* 10, 1944 (483–91 + plate). [Span.] [Instituto Miguel Lillo.] A.P.B. [686].

The new species *Ficus maroma* Castell., sp. nov., is described and discussed. The text is illustrated by diagrams showing a fruiting branch, the general structure and appearance of the reproductive organs, and the distribution of the species in northwest Argentina. Special reference is made to the peculiar method of insect pollination. A photographic plate of the whole plant is appended.

12.26–8 (82). SANTOS BILONI, J. Plantasde nuestra flora: los blanquillos. **[Plants of our flora: the 'blanquillos' [of the Rio Plata].]** *Suelo argentino* 4, 1945 (173, 188). [Span.] A.P.B. [687].

The 'blanquillos' of the Rio Plata region (so named on account of their whitish appearance) include various trees and shrubs of the genus *Sebastiania* (Euphorbiaceae). The author describes the appearance and distribution of three species: *Sebastiania brasiliensis* Spreng., *S. klotzschiana* Müll. Arg., and *S. schottiana* Müll. Arg.

12.26–8 (82 : 84) : 31.2. SANTOS BILONI, J. El 'coco' o 'cochucho'. **[*Fagara coco* (Gill.) Engl.]** *Suelo argentino* 4, 1945 (325). [Span.] A.P.B. [688].

A general description of *Fagara coco* (Gill.) Engl. (= *Zanthoxylum coco* Gill.), a tree species commonly found in the mountain regions of Argentina and extending into Bolivia. It belongs to the Rutaceae and is known locally as 'Coco', 'Cochucho', and 'Saúco Hedionda'. In the northern provinces of Argentina it reaches a height of 12 m. and a trunk diameter of more than 70 cm., but at lower altitudes it may often be reduced to a mere shrub. The wood of the Coco is yellow in colour, moderately heavy (0·662 kg. per cu. dm.) and easy to work. The bark contains 8 per cent. of tannin.

12.26–8 (85 : 86). CROIZAT, L. **One old and two new species of *Phyllanthus* from northwestern South America.** *Caldasia* 3 (11), 1944 (21–2). [Arnold Arboretum, Harvard Univ.] K. [689].

Descriptions of *Phyllanthus lacerilobus*, sp. nov., from Peru, *P. haughtii*, sp. nov., from Ecuador and *P. popayanensis* Pax.

12.26–8 (86) : 12.19. STEERE, W. C. **A report of some recent collections of Rubiaceae from Ecuador.** *Bull. Torrey bot. Cl.* 72, 1945 (295–311). [Univ. of Michigan, Ann Arbor, Mich.] O.B.D. [690].

The main part of this paper consists of a list (giving detailed geographic data) of Ecuadorian Rubiaceae collected by the author in various parts of Ecuador (particularly the northernmost provinces of Carchi, Imbabura and Napo-Pastaza) during a search for Cinchona and other possible sources of quinine on behalf of the United States Office of Foreign Economic Administration in 1943 and 1944. Many new species are included.

12.26–8 (86) : 34.26 : 44.3 : 12.21. SCHULTES, R. E. **Plantae colombianae VIII.** *Caldasia* 3 (11), 1944 (23–32). [E.] [Harvard Botanical Museum.] K. [691].

A description is given of a new variety of *Hevea* found in Colombia, *H. viridis* Huber var. *toxicodendroides* R. E. Schultes and E. L. Vinton, which differs from *H. viridis* chiefly in being very much smaller in all its parts; the latex is always pure white.

Although conditions during the rainy season are very favourable for the growth of the fungal leaf-blight disease *Dothidella ulei* P. Henn in the type locality, *H. viridis* var. *toxicodendroides* appears to be fairly resistant to the disease. It is also a highly xerophytic plant. These two characteristics may be a valuable element for breeding purposes.

12.26–8 (86). DUGAND, A. Nuevas nociones sobre el genero *Ficus* en Colombia, IV. **[New ideas on the genus *Ficus* in Colombia, IV.]** *Caldasia* 3 (12), 1944 (133–48). [Span.] K. [692].

A discussion on the species *Ficus glabrata* H.B.K., with special reference to the features which distinguish *F. glabrata* H.B.K. var. *obtusula* Dugand, var. nov., from *F. glabrata* H.B.K. var. *typica* Dugand, var. nov. In addition to being more coriaceous, the leaves of var. *obtusula* are generally longer and, above all, broader than those of var. *typica*; the petiole and stipules are also noticeably longer. The two varieties do not differ much in regard to geographical distribution.

12.26–8 (86). DUGAND, A. Noticias botanicas Colombianas, III: Especies nuevas y criticas. **[Colombian botanical notes, III. New and critical species.]** *Caldasia* 3 (11), 1944 (33–8). [Span.] K. [693].

The following new species are described:—*Mimosa coroncoro* Killip and Dugand, a shrub 3–4 m. high; *Bulnesia carrapo* Killip and Dugand, a tree 12 to 15 m. high.

12.26–8 (86). CROIZAT, L. Euphorbiaceae novae vel criticae Colombianae IV. [**New or critical Euphorbiaceae from Colombia, IV.**] *Caldasia* 3 (11), 1944 (7–20). [E.] [Arnold Arboretum, Harvard Univ.] K. [694].

An amended classification is proposed for the genus *Croton* L. and some 17 Colombian species are described, including *Croton chocoanus*, sp. nov., a tree 6–8 m. high, which is tentatively assigned to this genus, and *C. sibundoyensis*, sp. nov., a shrub.

12.26–8 (87). LASSER, T. Plantae novae Venezuelanae. [**New plants of Venezuela.**] *Bol. Soc. venez. Cienc. nat.* 9, 1944 (177–9 + plates). [Span.] I.I.E. [695].

Two of the three species described are trees of the genus *Persea—P. lignitepala* Lasser, and *P. pachytepala* Lasser. The accompanying plate gives drawings illustrating the leaf and reproductive organs of the former species.

12.26–8 (87). PITTIER, H. Notas dendrologicas de Venezuela. VII., VIII., IX. [**Notes on dendrology from Venezuela. VII., VIII., IX.**] *Bol. Soc. venez. Cienc. nat.* [7], 1942 (303–14); 8, 1943 (257–64); 9, 1944 (119–24). [Span.] I.I.E. [696].

New tree species from the genera *Olmedia*, *Aleza*, *Coussapoa*, *Ficus*, *Dalbergia*, *Taralea*, *Clitoria*, *Machaerium* and *Esenbeckia* are among the woody plants listed and described.

12.26–8 (87). LASSER, T. Dos arboles interesantes de la flora venezolana. [**Two interesting trees of the Venezuelan flora.**] *Bol. Soc. venez. Cienc. nat.* 8, 1943 (233–6). [Span.] I.I.E. [697].

The two species described in this paper are *Meliosma meridensis* Lasser, sp. nov., (Sabiaceae) and the well-known Páo Rosa or Bois de Rose (*Aniba rosaeodora*, Lauraceae). Notes are included on the distribution and uses of the latter species.

12.26–8 (87). LASSER, T. Las especies venezolanos de las Dichapetalaceae. [**The Venezuelan species of Dichapetalaceae.**] *Bol. Soc. venez. Cienc. nat.* 9, 1944 (125–8 + plate). [Span.] I.I.E. [698].

The author discusses the origin of the name Dichapetalaceae and the affinities, characters and distribution of the family. Two species of the genus *Dichapetalum* and two species of the genus *Tapura* are described with synonymy. They include *T. guianensis*, a tree species from the basin of the Orinoco.

12.26–8 (95). MERRILL, E. D., and PERRY, L. M. **Plantae Papuanae Archboldianae, XVI.** *J. Arnold Arbor.* 26, 1945 (229–66). [699].

An annotated list of species belonging to 13 genera of the Rubiaceae, including trees of the genera *Urophyllum*, *Pachystylus*, *Canthium*, *Antirrhea*, *Timonius*, *Mastixiodendron*, *Coffea*, *Ixora* and *Versteegia*. New tree species are described in the genera *Canthium*, *Antirrhea*, *Timonius*, *Mastixiodendron* and *Ixora*.

12.29. Monocotyledons

12.29 (729.1) : 01.2. CARABIA, J. P. Notas sobre la nomenclatura de algunas palmas Cubanas. [**Notes on the nomenclature of some Cuban Palms.**] With comments in Spanish by H. Léon. *Carib. For.* 6, 1944–45 (159–70). [Span.E.f.] [700].

13. FOREST ZOOLOGY

13.1. *General Zoology*

13.11 : 13.2. PETKOV, P. Der Einfluss des Futters auf die Entwicklung des Goldafters *Nygmia phaeorrhoea* L. und des Ringelspinners *Malacosoma neustria* L. [**The influence of diet on the development of *Nygmia phaeorrhoea* and *Malacosoma neustria*.**] *Verh. 7. int. Kongr. Ent., Berlin 1938* 4, 1939 (2388–95). [G.] R.A.E. 33A, 1945 (119). [701].

An account of laboratory experiments in Bulgaria, in which larvae of *Nygmia phaeorrhoea* Don., collected on Plum and Oak were reared on Oak leaves, and larvae of *Malacosoma neustria* L., collected on Oak were reared on leaves of the same species of Oak, on Beech leaves or on a mixed diet of leaves of various trees, including several species of Oak. From the rate of development and eventual size of the larvae, it appeared that the change of diet was unfavourable for *Nygmia* and the mixed diet the most favourable for *Malacosoma*; the latter developed most slowly on Beech leaves. The author concludes that polyphagous larvae prefer, and develop most rapidly on, leaves rich in tannin.

13.15 : 13.2 : 12.26–8. TWOMEY, A. C. **The bird population of an Elm-Maple forest**

with special reference to aspection, territorialism, and coactions. *Ecol. Monogr.* 15, 1945 (173–205). [702].

The area studied lies within the Red Oak/Maple ecotone between Beech/Maple and Oak/Hickory associations. Twenty-nine per cent. of the total tree population consists of Sugar Maple (*Acer saccharum* Marshall) and 22 per cent. is American Elm (*Ulmus americana* L.) and Red Elm (*Ulmus fulva* Michx.). Red Oak (*Quercus borealis* Michx. var. *maxima* Ashe) is prominent in the climax portion. Other species frequently found in the area are *Fraxinus americana* L., *F. quadrangulata* Michx., *Tilia americana* L., and *Carpinus caroliniana* Walt.

The author discusses aspection, seasonal changes in the bird population of the various aspects (hiemal, prevernal, vernal, aestival, serotinal and autumnal), bird societies (ground/low shrub, high shrub, tree trunk, and upper canopy societies), seasonal societies, survival percentages in three species (indigo bunting, red-eyed vireo and wood thrush), population density and carrying capacity of the woods, and food preferences. Diagrams are given showing the food cycle for the hiemal and aestival periods.

13.2. *Special [Systematic] Zoology*

13.2 (72 : 728 : 729 : 8). BLACKWELDER, R. E. **Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America. Parts 1 and 2.** Smithsonian Institution, Washington, D.C. 1944. pp. 341. [703].

13.2 (931) : 31.43. KELSEY, J. M. **The identification of termites in New Zealand.** *N.Z. J. Sci. Technol.* 25B, 1944 (231–60). P.R. [704].

Detail descriptions of the New Zealand species *Calotermes brouni* Frogg., and *Stolotermes ruficeps* Brauer and of the following eight species accidentally introduced into New Zealand from Australia: *Coptotermes frenchi, C. acinaciformis, C. lacteus, Porotermes adamsoni, Calotermes tuberculatus, C. condonensis, C. insularis* and *Eutermes walkeri.* Of these Australian species *Coptotermes frenchi, C. acinaciformis* and *C. lacteus* are of common occurrence, *Prototermes adamsoni* and *Calotermes insularis* have been found three times or more, while *Calotermes tuberculatus, C. condonensis* and *Eutermes walkeri* are represented by single records.

2. SILVICULTURE

2 (47.1) : 56 : 12.25 : 12.11.3 : 23.1 : 33.0 : 12.19.2. SCAMONI, A. Forstliche und vegetationskundliche Beobachtungen in Finnland. **[Forest and vegetational observations in Finland.]** *Forstarchiv* 18, 1942 (341–51). [G.] [705].

Observations are made on (1) the successful plantation of Siberian Larch at Raivola, at the southeastern tip of Finland, which shows an amazingly high yield in spite of the fact that the species is 200 km. outside its natural range; (2) the experimental area of Punkaharju in east central Finland, in one section of which the cultivated progeny of the Larches of Raivola have shown even more rapid growth than the original trees; (3) uses of timber in Finland; (4) races of Pine (narrow-crowned and broad-crowned); (5) natural regeneration of Pine in the north; and (6) the Finnish forest types and their relation to north German forest communities. While Larches of different provenance have given exceptionally good results in the Punkaharju area, Spruce of both northern and southern provenance falls far behind the indigenous stock. A note is given on the silvicultural method of Melder (*Commentationes forestales* 3, 1929) whereby the ground flora is not removed, but only bent aside, and Pine is sown in a furrow so as not to disturb the favourable water régime brought about in this particular area by the moss cover.

2 (54) : 06.2 : 07.2. GRIFFITH, A. L. **Sixth Silvicultural Conference (Dehra Dun—April 2nd to 4th, 1945).** *Indian For.* 71, 1945 (187–91). [706].

Owing to the war, silvicultural research in India has been largely in abeyance. The resolutions of the 1945 conference (which still await administrative sanction) cover the effect of war on silvicultural and yield prescriptions of working plans; co-operative seed collection and distribution; efficiency of enumerations; afforestation of dry areas, and joint co-operative investigation or tours to study the regeneration of Fir, Salai, Sal, Casuarina and Teak. It is proposed that the silvicultural research manuals should be revised and expanded and other reference works should be reprinted.

2 (81) : 12.25–8 : 33 : 11.4 : 11.62. SOBRINHO, V. Introdução a silvicultura do nordeste. **[Introduction to the silviculture of the northeast [of Brazil].]** *Arq. Inst. Pesq. agron. Pernambuco* 2, 1939 (127–219 + plates). [Port.] C.G.B. [707].

The five main sections of this paper deal with (1) the forest soil; (2) the forest (natural and artificial formations; reforestation; conservation; forest products); (3) the forest trees (individual species with their uses); (4) the influence of the forest on the water régime; and (5) phytogeographic data pertaining to Pernambuco.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.1. *Light and Temperature Requirements*

21.11 : 12.25. BAKER, F. S. **Effects of shade upon coniferous seedlings grown in nutrient solutions.** *J. For.* 43, 1945 (428–35). [University of California, Berkeley, Calif.] [708].

All studies of the reactions of plants to lower light intensity have encountered a technical difficulty in making certain that the plants in all degrees of light are watered adequately and equally. To eliminate variation in water supply, and also to ensure uniformity and adequacy in the supply of mineral nutrients, the reactions of coniferous seedlings to reduced light was tested with plants grown in an aerated nutrient solution. The main result showed that tolerance is remarkably complex and that simple efficiency of photosynthesis is not a particularly important element in it.

Details of the experiment are given and the dry-weight increments of seedlings of the various species are plotted in relation to varying light intensities. Three points are evident: (1) the light intensity which gives zero increment varies very little among the different species; (2) the efficiency in full sunlight is extremely variable (*Pinus jeffreyi* increases only 18 times, *P. radiata* 860 times); (3) graphs for four species (*Larix occidentalis*, *Pinus radiata*, *Sequoia sempervirens*, *Chamaecyparis lawsoniana*) approximate straight-lines, while the other four (*P. ponderosa*, *P. jeffreyi*, *Libocedrus decurrens*, *Abies concolor*) are curvilinear with a tendency to flatten off at high intensities. The dwarfing of the root systems of plants grown under reduced light was marked in all species, the differences being small and correlation with reputed tolerance very poor. A crude correlation of height growth and slenderness with tolerance was observed in most species. The closest correlation was between mortality and reputed tolerance. The results as a whole tend to contradict the idea that tolerance and intolerance are fixed categories, and to show sharp individual differences between species. *Larix occidentalis* in many respects conforms to the classical pattern of the intolerant tree, though its large root system, persistent even in low light intensities, is unexpected. *Pinus ponderosa* and *P. jeffreyi* show few characteristics that would seem logical for intolerant trees and the reason why they fail to reproduce successfully under forest canopies is not clear. *P. radiata* is a species of striking individuality, its increment in grams per tree far exceeds that of all species; it flourishes best in full light, but it increases its weight some sixty-fold even in light of 10 per cent. intensity and its mortality is moderate at the lowest intensities used. The root system is small relative to the top and its reduction under low light intensities is marked. *Pseudotsuga taxifolia* developed in a strikingly uniform manner and varied little with different degrees of light. Growth was relatively good at 10 per cent. light and best at 50 per cent. The root systems were relatively large and well maintained at low light intensities. On theoretical grounds it would appear to be a distinctly tolerant species. *Libocedrus decurrens* showed high mortality at the lowest light intensity. *Sequoia sempervirens* develops very rapidly and at 10 per cent. intensity outgrows all other species, but relative to growth in full light it shows no remarkable efficiency at low intensity. Survival under low light intensity is excellent. *Chamaecyparis lawsoniana*, undoubtedly the most tolerant of the group, appears to suffer from full light (or more probably from the high temperatures that go with it), growth being much reduced and mortality high.

21.3. *Soil Requirements*

21.3 : 12.25–8 : 11.41.3. PLICE, M. J. **Uptake of minerals by trees in successive years.** *Proc. Okla. Acad. Sci. 1943* 24, 1944 (60–73). [Oklahoma A. and M. College, Stillwater.] L.S. [709].

A study was made of the influence of climate

on the mineral metabolism of twenty-two trees of twenty different species, using the ash contents of the tree leaves as evidence. Data are given for each tree for the years 1938 to 1942. Chemical analysis of the leaves indicated that mineral uptake follows trends of soil moisture. The ash materials (particularly silica and calcium) tended to increase in wet years, while total nitrogen increased with decreasing soil moisture. Magnesium and manganese varied somewhat irregularly and iron and calcium entirely so. Acidity decreased somewhat irregularly with increasing soil moisture.

21.32 : 12.25 : 11.42.2 : 12.11.23. BENSEND, D. W. **Effect of nitrogen on growth and drouth resistance of Jack Pine seedlings.** *Tech. Bull. Minn. agric. Exp. Sta.* No. 163, 1943. pp. 63. P.R. [710].

A full account of the technique and results of experiments with 1- and 2-year-old seedlings of *Pinus ponderosa* devised to determine the optimum nitrogen supply for maximum growth, the effect of nitrogen on drought resistance, the amount of available nitrogen in the soil, and a practical method of compensating deficiency of nitrogen. It was found that the N-content of seedlings making best growth is about 2·2 per cent., and that seedlings receiving the optimum supply (200–250 p.p.m.) are the most drought-resistant and as resistant as seedlings grown in nitrogen-deficient soil, but resistance falls off with increase of nitrogen over the optimum. The local soil contained about one-half the amount of N needed for best growth; this was increased to the optimum by applying weekly to each sq. ft. 0·45 l. of fertilizer containing 100 p.p.m. of nitrogen.

21.32 : 11.47.13 : 12.26–8 : 12.14.3–5. GONCHAROV, E. R. Mineral'noe pitanie drevesnykh rasteni (po rezul'tatam vegetatsionnȳkh opȳtov 1937–1939 gg.). [**The mineral nutrition of woody plants (based on the results of growth experiments 1937–39).**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 21, 1941 (73–118). [Russ.] [711].

The experiments consisted of several NPK treatments in varying ratios on *Euonymus verrucosus*, *Populus tremula*, *Quercus pedunculata*, *Fraxinus excelsior* and *F. pennsylvanica*. Results are tabulated and discussed in some detail, and the following general conclusions are drawn:—The development of a fibrous root system needs sufficient P in the early stages of growth, with comparatively little N and K, though the latter are increasingly needed as the plant develops. Young seedlings are particularly sensitive to excess of N and K salts; whereas P promotes initial development, excess N brings about the accumulation of non-protein forms which retard growth. Judgment in the application of mineral fertilizers is required to secure a proper balance of moisture and oxygen so that the plant can utilize fertilizers. During experiments on N : P ratios the best results with woody species were obtained with $P_2O_5 = 2$ and $N = 1$, with $K = \frac{1}{2}$ or 1. Later experiments showed that supplements of N in two instalments had no positive influence on height growth but promoted development of the root system and growth of the seedlings in thickness. The first practical criterion for determining the best type of standard planting stock must be based on dimensions and form of the stem and roots, and on weight ratios between the several parts of the plant. For *Fraxinus pennsylvanica* the best weight ratios for roots, shoot and leaves (taking total plant weight as 100) are believed to be 35 : 30 : 35.

Russian and other literature is reviewed.

21.6. *Behaviour in the Stand*

21.64 : 21.1–2 : 12.25 : 12.19.4. LUTZ, H. J. **Vegetation on a trenched plot twenty-one years after establishment.** *Ecology* 26, 1945 (200–2). [School of Forestry, Yale Univ.] [712].

Reference is made to one of a number of trenched plots that were established in the Yale Demonstration and Research Forest in 1922, 1923 and 1924. A detailed record of the vegetation on this plot in 1930 was published in 1931 (*Yale For. Bull.* No. 30).

Between 1930 and 1943 the herbaceous vegetation on this plot showed a remarkable change, the number of species having decreased from 19 to 9, the number of individuals from 1830 to 162, and density of ground cover from 48·4 to 3·4 per cent., although density of total vegetative cover increased from 80 to 100 per cent.

There were also marked changes in the tree vegetation during this period; the 26 White Pine present in 1930 were all dead by 1943, as were the Red Spruce, Trembling Aspen, Gray Birch, Willow and Black Cherry. On the other hand, all Hemlock present in 1930 were flourishing in 1943, with one new seedling; the

one Balsam Fir had grown well and two seedlings had appeared, as had two Serviceberry and Paper Birch seedlings.

It is concluded that, while the importance of soil moisture and root competition has been demonstrated, solar radiation appears to be the significant factor determining tree species composition, being too low for the relatively shade-intolerant White Pine but favourable for the shade-tolerant Hemlock.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22 (71). ROBERTSON, W. M. **Some observations on silvicultural cutting methods.** *Silvic. Res. Note Dom. For. Serv.* No. 75, 1945. pp. 18. [713].

Standard silvicultural cutting methods are reviewed and classified with particular reference to the management of Canadian pulpwood forests; each method is described and the advantages, disadvantages and possibilities of its application are stated. Clear-cutting is recommended for even-aged mature stands in Spruce/Fir and White Birch/Spruce/Fir types, provided that ample reproduction is assured and that no serious danger to adjoining stands nor of soil erosion will result. Where such danger is likely, clear-cutting in groups should be practised. For maximum increment and better distribution of age classes, the diameter-limit modification of the selection system should be applied to overmature uneven-aged stands of any type, except where the remaining stand may be endangered by wind, in which case there is no alternative to clear-cutting. The standard selection method will yield the best results silviculturally in any type, but it can only be practised economically on small areas where the owner operates at short intervals. There is need for research on the possibilities of intermediate cuttings.

22.2. *Coppice Forest*

22.2 (42.9) : 23.2. RYLE, G. B. **The coppice woodlands of South Wales.** *Quart. J. For.* 39, 1945 (81–7). [Forestry Commission.] [714].

Almost all the hardwood coppice woods in South Wales which had reached pitwood size were cut during the war, leaving only (1) young thicket coppices from pre-war fellings which are yet too immature to cut but which have already attained a closed-canopy stage; (2) areas felled during the past 5 years and now bare or with re-growth up to 5 years; (3) rough-class older coppices which, owing to senile stools, bad soil or exposure, have no promise and are too crooked to be worth felling for productive purposes.

During the war South Wales collieries have been obliged to use hardwood props, which have proved to be of surprisingly good quality and suitability, and it is suggested that the amount yielded by the South Wales coppice areas in future could be easily absorbed, and that class 1 coppices mentioned above should be managed for this purpose. Most of the coppices of class 2 are small, long, and narrow; from the silvicultural point of view the best treatment would be to exclude sheep and rabbits and then replant with softwoods. Douglas Fir in the more sheltered sites and Japanese Larch elsewhere would be generally suitable, with some Norway Spruce in moist places (after draining) and at higher elevations. European Larch has not proved suitable in these woods and any species particularly liable to be affected by *Armillaria mellea* should not be used. Details are given of the way in which this replanting can be done without completely clearing the young regrowth.

The cheapest treatment for coppice of class 3 would be to girdle the existing trees and replant with moderate shadebearers either at once or in about two years. Where this procedure is objectionable on account of amenity, the alternative is clear felling followed by regeneration.

22.8. *Silvicultural Description of Forms of Stand*

22.89 (68.9) : 12.25 : 21.0 : 21.61. CLEMENTS, J. B. **Pines in Nyasaland.** *Nyasaland agric. quart. J.* 5, 1945 (44–5). [715].

[Cf. *For. Abstr.* 5 (31).] Results from Pine plantation plots established at Zomba are indicated briefly: *Pinus khasya* shows very fast growth and good form but appears to require sheltered conditions; *P. echinata* is growing well and has good form; *P. teocote* and *P. leiophylla* are fast-growing but have poor form; *P. merkusii* and *P. arizonica* are slow-growing while *P. macrophylla* and *P. ponderosa* show very poor growth.

23. FORMATION OF STANDS

23.1. *Natural Regeneration*

23.1 : 12.25 : 21.11 : 21.3 : 12.19. SHIRLEY, H. L. **Reproduction of upland conifers as affected by root competition and light.** *Amer. Midl. Nat.* 33, 1945 (537–612). [Northeastern Forest Exp. Sta., Philadelphia, Pa.] [716].

Investigations carried out in Chippewa National Forest on the growth of four species of conifers (*Pinus resinosa, P. strobus, P. banksiana* and *Picea glauca*) indicate that competition of subordinate vegetation is one of the most important factors preventing invasion of Aspen forest having a conifer seed supply. In Red Pine (*P. resinosa*) and Jack Pine (*P. banksiana*) stands the success of coniferous reproduction was also dependent chiefly upon the absence of intense competition of the subordinate vegetation. Compared with this, the shade and root competition of trees forming the overstorey were of secondary importance. Shade of the overstorey, if not too dense, was found to favour both germination and survival of seedlings, particularly on the drier soils where root competition for moisture appears to be more keen.

Either shade or root competition may be limiting factors in the growth of young conifers. Shade is likely to be the more important under the secondary canopies in Aspen stands; root competition the more important among low shrubs, grass and other herbs beneath Red and Jack Pine stands.

Despite the occurrence of severe droughts during the course of the experiments, survival beneath Aspen, Red Pine, and Jack Pine canopies was found to be dependent more on adequate light intensity than on the degree of root competition. The ability of the four species to survive in dense shade increases in the order: Jack Pine, Red Pine, White Pine, and White Spruce. *From author's summary.*

23.1 : 12.25–8 (42.1–8). EDLIN, H. L. **Natural reproduction of trees and shrubs introduced to the New Forest.** *Quart. J. For.* 39, 1945 (91–9). [Forestry Commission.] [717].

Twenty-four foreign species of trees and shrubs and 6 species introduced artificially from other parts of Britain are recorded as regenerating naturally in the New Forest area (southern England). The author suggests and defines nine degrees of natural survival, covering three or more generations, as a basis for measuring the extent to which these introductions have progressed in establishing themselves.

A brief account is given of the natural features, vegetation and tree flora of the New Forest; the countries of origin of the introductions and the actual localities in which they were observed in the Forest are recorded, together with the degree of natural survival probably attained.

23.1 (729.7) : 12.19 : 44.1 : 24 : 11.48.2–3. BEARD, J. S. **A silvicultural technique in Trinidad for the rehabilitation of degraded forest.** *Carib. For.* 6, 1944–45 (1–33). [E.Span.f.] [718].

A description of the technique evolved in the McNair Ravine Sable Forest Reserve which was constituted in 1934 mainly on abandoned cultivated land; it consists essentially in encouraging natural regeneration by shelterwood methods combined with thinning and cleaning [cf. *For. Abstr.* 3 (211)]. Detailed descriptions are given of the individual compartments of the forest. The salient point of the silvicultural results, which is confirmed by experience elsewhere in Trinidad, is that natural regeneration occurs readily on sandy soils, but relatively weakly on clays, particularly heavy clays. On sandy soils a timber forest usually grows back fairly rapidly, but on clays there is a long period when the worthless *Cecropia, Ochroma, Vismia,* and *Guazuma* are the chief tree species. A factor equally important to regeneration is the seed dispersal mechanism of the different species. Among the valuable species at McNair, *Terminalia, Tabebuia* and *Cedrela* have winged seeds that are widely dispersed by wind, and the seeds of *Byrsonima, Didymopanax, Hieronyma* and species of Lauraceae are distributed by birds and bats. These species regenerate much more copiously than other valuable species which have relatively large and heavy seeds without any natural dispersal mechanism.

In general, the pioneer species, while easy to propagate, are of little value, and the most valuable timbers are found in the final and climax stage. The best principle in natural regeneration operations is to select as a compromise species of reasonably good timber which occur fairly early in the succession. In Trinidad *Byrsonima spicata, Didymopanax*

morototoni, Hieronyma caribaea, Tabebuia serratifolia, and *Terminalia obovata* regenerate readily and are fast-growing in their early stages; one is a first-class hardwood, three are medium-quality hardwoods, and one a medium-quality softwood. These are relied on to provide the main portion of the crop.

23.13 : 12.25 (77.8) : 24.36. LIMING, F. G. **Natural regeneration of Shortleaf Pine in the Missouri Ozarks.** *J. For.* 43, 1945 (339–45). [Central States Forest Exp. Sta., Columbus, Ohio.] [719].

In 1938, the Central States Forest Experiment Station in co-operation with the Mark Twain National Forest, initiated a study to test the effects of ground preparation, density of overstorey and seed supply on natural regeneration of Shortleaf Pine (*Pinus echinata*) in Oak/Pine stands in the Missouri Ozarks. The results of 5 years' study are presented in this article.

The study involved 4 plots, each containing 25 milacre quadrats. The canopy on two of the plots was reduced from 80 per cent. to 20 per cent. closure by girdling some of the overstorey trees. Each of the following ground treatments was given to one-fifth of the quadrats: (1) raking and cultivation, (2) cultivation without raking, (3) raking, (4) burning, (5) no ground treatment. Shortly after these treatments were given, Shortleaf Pine seed was sown broadcast, simulating natural seed fall, at the rate of 100,000 viable seed per acre.

The catch of seedlings under natural conditions was 13·4 per cent. and 2·7 per cent. at the end of the first and fifth growing seasons respectively. Cultivation of soil after removal of litter was the only ground treatment which resulted in significant increase in seedling establishment during the first 5 years. Ground treatments had no significant effect on height growth of seedlings. Reduction of the overstorey did not materially increase the catch at the end of the first year, but did increase the subsequent survival of seedlings. Survival at the end of the fifth year averaged 16 per cent. under the natural overstorey and 60 per cent. under the reduced overstorey. Reduction of the overstorey brought about a decided increase in height growth of seedlings during each of the first five years. At the end of the fifth year the two best seedlings on each quadrat under natural and reduced overstorey averaged 7 in. and 48 in. respectively. Seed production of existing small Pine trees is apparently very low and constitutes an important limiting factor in natural regeneration of the species in these stands. In order to increase the rate of natural regeneration, it is recommended that at least 1–5 dominant Pine trees 12–18 in. d.b.h. be retained on each ¼ acre and that, following a good seed year, the overstorey be reduced as much as possible by harvesting merchantable material and girdling undesired trees during the following dormant season.

23.2. *Artificial Regeneration*

23.2 (67.8). TANGANYIKA. **Twenty-third annual report of the Forest Department, Tanganyika Territory, for the year ended 31st December, 1943.** Govt. Printer, Dar es Salaam. 1944. pp. 12. [720].

A review of the position in regard to artificial afforestation revealed that plantations raised departmentally amounted to 5,573 acres and communal plantations to 3,643 acres. An appendix to the report indicates the range of species employed, with classification according to ownership and the character of plantations. (p. 6.)

23.21. Choice of Species

23.21 : 12.26–8 : 33.12. **The planting of Lime.** *Timb. Tr. J.* 173, 1945 (247–8). [721].

It is pointed out that Lime (*Tilia* spp.) is a very useful timber in all stages of growth; in the pole stage it makes admirable turning wood, and if creosoted under pressure is useful for fencing. In larger sizes it is excellent turning wood for household goods and bobbins or spools, and is one of the best substitutes when there is a shortage of conifers.

It is quick-growing wood, and when grown in plantations and coppice, produces very clean timber. Four species are widely grown in Great Britain, and of one species there are many varieties. There are, moreover, natural hybrids. It is important that if plantations are made, care should be taken to use seeds from those species or varieties with the best timber characteristics.

23.21 : 23.24 : 23.27. ROBREDO, L. H. Tres arbolados dificiles. [**Three difficult types of tree planting.**] *Rev. agric., Guatemala* Nov. 1944 (32–4). [Span.] E.M.B. [722].

A discussion on the unfavourable environmental factors which must be taken into consideration when trees are to be planted in

towns, in coastal districts and along roads and highways. Species suggested for town planting are Acacias, the Japanese Pagoda tree, Elm (*Ulmus 'campestris'*) and Plane (*Platanus occidentalis* and *P. orientalis*). For seashore planting, *Ligustrum coriaceum, Tamarix, Pinus laricio, P. pinaster* and the shrub *Pittosporum chinensis* are recommended. The Plane is a particularly suitable roadside tree.

23.21 : 12.26–8 : 31.0 : 2. ARAUJO, L. C. *Vanillosmopsis erythropappa* (DC.) Sch. Bip.: sua exploração florestal. [***Vanillosmopsis erythropappa* (DC.) Sch. Bip.: its possibilities as a forest tree.**] *Bol. Soc. brasil. Agron.* 7, 1944 (101–51). [Port.] I.I.E. [723].

A comprehensive paper dealing with the species *Vanillosmopsis erythropappa* under two main headings:—(1) identification; and (2) possibilities as a forest tree. Sections are included dealing with dendrology, scientific and vernacular names, the appearance of all parts of the tree, general properties of the timber, ecology, distribution, environmental and biotic factors, tolerance, reproduction, growth, and various aspects of silviculture, management and utilization.

The author considers that this species is capable of producing sufficient woody material to justify its cultivation as a forest tree. It shows rapid growth and is easily propagated both by seed and cuttings. The wood is of even texture, compact, heavy, durable, and of good resistance. It burns easily leaving little residue.

23.21 : 12.26–8 (41.5) : 21.64 : 21.12. O'BEIRNE, M. **Notes on *Eucalyptus* species at Avondale, Co. Wicklow.** *Irish For.* 2 (1), 1945 (23–6). [724].

Seed of *Eucalyptus muelleri, E. urnigera, E. coccifera* and *E. ovata* was received from Tasmania in 1908, and sown at Avondale; at one year the seedlings were planted out, the plants being set 5 ft. apart each way. They were cultivated during the first 2 years and little was then done to them for 25 years, after which some lanky and suppressed poles were removed. All species made rapid growth and proved hardy until the severe frost of 1939 when *E. ovata* suffered badly from frost crack and, though not killed, had a severe setback. The following are particulars of the surviving trees from measurements taken in January, 1945.

Species	*No. of trees*	*Av. height ft.*	*Q.G.B.H. in.*	*Average volume per tree cu. ft.*
E. muelleri .	11	105	12½	43
E. urnigera .	7	108	13¼	50
E. coccifera .	5	73	11¼	29
E. ovata .	11	107	12½	45

All the trees in the group of *E. ovata* grew tall, straight and clean, but the severe frost killed about half their crowns and split the bark down to the base. The foliage of this species was again damaged by the severe frost of January, 1945.

E. muelleri (= *E. johnstoni*) proved perfectly hardy and formed tall, straight, clean trees with light crowns.

E. urnigera also proved perfectly hardy, forming tall, straight trees, but rather branchier and rougher than *E. muelleri.*

E. coccifera is extremely hardy but hardly suitable for timber as it grows rough and branchy.

Other species subsequently planted at Avondale were *E. globulus* and *E. regnans*, which were soon killed by frost, and *E. gigantea* which withstood the frost and is growing vigorously.

At Ballymanus, near Glenealy, Co. Wicklow, within 4 miles of the sea, the following species, planted in 1934, withstood the frost and are growing vigorously:—*E. muelleri, E. viminalis, E. urnigera, E. amygdalina, E. gigantea, E. dalrympleana, E. radiata.* These trees are now up to 35 ft. in height with average Q.G.B.H. of 4 in. At Kilmacurragh, Co. Wicklow, there is a large tree of *E. cordata.*

23.21 (410) : 12.25. DALLIMORE, W. **Two possible forest trees for Britain.** *Quart. J. For.* 39, 1945 (88–91). [725].

Serbian Spruce (*Picea omorika*) has a restricted natural distribution, being confined to the limestone mountains on both sides of the River Drina at an altitude of 2,700–3,500 ft. Experiments at the National Pinetum at Bedgebury have shown that this species will do well on an acid soil at low elevation. Young trees (15–18 in. high) planted in 1926 are now about 30 ft. high, 27 in. in girth at 5 ft. above ground, and have a branch spread near the ground of 16 ft. They have not been injured by winter or spring frosts, nor attacked by insect pests. Trees planted in 1931 are now 20–22 ft. high, and in 1942 they bore a heavy

crop of cones with a fair percentage of fertile seeds. Preliminary tests of the timber will soon be possible from thinnings. The great value of this species would appear to be for planting in places where other Spruces are liable to injury by spring frosts; but there is likely to be difficulty in procuring seed for some years to come and every opportunity should be taken of collecting any available cones from home-grown trees. As this species grows more slowly in its earliest years than either Norway or Sitka Spruce, it requires a year or two longer in the nursery.

Leyland's Cypress (*Cupressocyparis leylandii*), a hybrid of *Chamaecyparis nootkatensis* and *Cupressus macrocarpa*, is a very vigorous tree, having the hardiness of one parent and the rapid growth of the other; it is easily raised from cuttings, and appears well worth trying under forest conditions, particularly in low, wet sites.

23.21 (54.5) : 12.26–8 : 23.23.19 : 23.23.3. BHARGAVA, O. P. ***Prosopis juliflora* in Gwalior forests.** *Indian For.* 71, 1945 (191–3). [726].

The main problem of forest officers in Gwalior State is the regeneration and afforestation of the xerophytic fuel forests which are gradually disappearing as a result of heavy exploitation, unrestricted grazing, and the presence of immense quantities of wild game. Sporadic sowings with *Prosopis juliflora* during the last two years have given encouraging results and systematic experiments are now being made to find the best variety and source of seed suited to the locality. Direct sowing seems to be the most economic method for establishing this species, though highly successful results have been obtained by stump planting; at the end of one season plants established by this method are 1½–2 ft. high compared with 1 ft. for those established by direct sowing.

23.21 (67.8) : 12.25 : 12.26–8. TANGANYIKA. **Twenty-third annual report of the Forest Department, Tanganyika Territory, for the year ended 31st December, 1943.** Govt. Printer, Dar es Salaam. 1944. pp. 12. [727].

Planting operations within two reserves of the Mbeya district consisted in raising over 40 acres of *Eucalyptus maideni* and *E. viminalis*, and nearly 20 acres of *Cupressus lusitanica* in 4 : 1 mixture with *Hagenia anthelmintica* and *Grevillea robusta*, used as soil improvers. The Eucalypts, although set in very poor soils, succeeded fairly well, with 60 per cent. survival and average height growth of 3 ft. The Cypress plantations gave 80 per cent. survival with an average height of 2 ft. at the end of the year (p. 4).

23.21 (82) : 12.26–8: 23.23–4. La Teca. La más valiosa especie forestal de Asia es de fácil cultivo en nuestro país. [**Teak. The most valuable Asiatic tree species can easily be cultivated in Argentina.**] *Mundo maderero* 5 (61), 1945 (7–8). [Span.] [728].

Trials with Teak (*Tectona grandis*) in Argentina have indicated that it can easily be acclimatized to conditions in that country, and it seems that its cultivation may be possible on a commercial scale. Brief notes are included on such practical matters as the preparation of the seed, nursery technique, sowing, spacing, and time of planting.

23.21–2 (42.1–8) : 12.25–8 : 11.48 : 09.1. AITKINS, A. E. **Forestry on the chalk downs at Leatherhead.** *Quart. J. For.* 39, 1945 (109–16). [729].

The author gives a short forestry history of an estate on the chalk downs near Leatherhead, Surrey, with special reference to the woodlands and plantations as found there in 1939. The difficulties met with in practising forestry on chalk are detailed and remedies suggested; the chief difficulties are caused by drought, late frosts, animal pests, weeds (including downland grass), and limitation of plantable species. Regeneration is dependent on tall cover, and clear-felling should never be practised. Where new plantations are to be established on grassland or scrub, the grass must be ploughed and left for one year before planting; a corn crop can be raised and the stubble ploughed in before planting. The natural and obvious species for chalk sites is Beech. Norway Maple (*Acer plantanoides*), Corsican and Austrian Pines also give good results, and if there is as much as 5 in. of soil, Ash does well on a short rotation. To establish Beech in open plantations it must be raised in mixture; Larch is commonly used, the minimum proportion of this species being 25 per cent. and the maximum 50 per cent. Norway Maple would probably make a good filler with Beech.

23.22. Preparatory Work. Auxiliary Measures

23.22 : 23.26.4 : 23.61 : 12.26–8. SCHREINER, E. J. **How sod affects establishment of hybrid Poplar plantations.** *J. For.* 43, 1945 (412–27). [730].

An experiment was started in 1940 at the Hopkins Experimental Forest, Williamstown, Mass., on land which has been under undisturbed turf for at least 25 years. Dormant cuttings of two hybrid Poplar clones, *P. maximowiczii* × *P. trichocarpa* and *P. maximowiczii* × *P. berolinensis* were used as planting stock. In some plots the cuttings were planted directly in sod, in some the sod was removed, and in others the sod was turned under. Half of each plot was weeded in the first year and half left unweeded. In addition to removal or turning under of sods, some plots were dug. The effects of the various combinations of treatments are shown in a series of diagrams and photographs. The results clearly indicate that the growth of hybrid Poplars is directly correlated with the available area of sod-free soil. The difference between cultivation and no cultivation was significant in the first year, but not in the 4 successive growing seasons and it must therefore be concluded that digging to a depth of 8 in. has no lasting advantage over no cultivation. The effect of sod turned under was highly significant at the end of the 1st, 2nd and 4th years, and the difference between this and the other two soil treatments was still increasing at the end of the 4th year. The difference between weeded and unweeded plots was highly significant for all years and has increased as the trees grow older (first year 0·34 ft., second year 0·55 ft., fourth year 1·26 ft.). Weeding becomes increasingly effective as the area of sod-free soil is enlarged. The beneficial effect of the sod turned under was even more striking. Average height of 4-year-old Poplars in weeded plots from which the sod has been removed was 5·8 ft., that on weeded plots with the sod turned under was 15·5 ft. A fertilizer experiment with some 30 hybrid Poplar clones adjacent to the blocks used for this study failed to show any such drastic effects even with comparatively large quantities of nitrogen in the fertilizer mixture.

The practical conclusions reached are that site preparation essential for successful establishment of hybrid Poplar on grassland must include (*a*) sod elimination to provide grass-free growing space (the minimum requirement under the conditions of this experiment was a strip 24 in. wide), and (*b*) turning the sod into the soil. Weeding during the first growing season is essential for maximum growth and survival; on some sites weeding for two or more years may be necessary. It is very probable that many forest species, particularly hardwoods, would respond similarly to this treatment, though not to the same extent.

23.22 : 23.52 : 12.14.3 : 12.25 : 12.11.23 : 11.43.1. SCHNEIDER, B. Die Entwicklung des Wurzelsystems der Kiefer in den dampfgepflügten Heideböden Nordwestdeutschlands und Versuche zur Feststellung der biologischen Verhältnisse dieses Gebietes. [**The development of the root system of Pine in the steam-ploughed heath soils of northwest Germany and experiments to determine the biological relations of this area.**] *Z. Forst- u. Jagdw.* 74, 1942 (353–73; 417–48). [G.] [731].

More than 70 years ago the view was held in forestry and forest-owning circles in western Germany that afforestation of the extensive waste lands of the north-west could be accomplished successfully provided that the soils were previously loosened, i.e. their physical properties materially improved. In the early plantations, planted stock at first made better progress than stock grown from seed, but after a few years the disparity disappeared, and all young growth was reported to be doing well. From the tenth year onwards, however, there generally occurred a marked reduction in growth. Many of the weaker trees died, leaving gaps in the plantations, although extensive areas of good stock survived.

In the Fuchshagen area (consisting mainly of brown earth and white sand) Pine seeds were broadcast in ridges in 1902 at a density of 10–15 kg. per ha., while in 1910, after burning the heath and distributing the well-developed heath humus with a disk harrow, ploughing was done to a depth of 45 cm., with a simultaneous harrowing of the ploughed area. To prevent soil compaction and the formation of raw humus and to enrich the soil with nitrogen, the coniferous plantations were mixed with Grey Alder. At first the plantations showed excellent growth, but later many trees became sickly and died. Best growth was maintained on brown earths where a vigorous Birch stand

occurred between the rows of Pines. This species appeared to further the development of the conifers and to reduce the harmful effects of late frosts. In the white sand area Birch was represented only sparsely and showed no signs of regenerating.

In the Dose forest (former waste land traversed by damp hollows) ploughing was carried out in 1887 to a depth of 65 cm. with a further 15 cm. loosened by means of an underground hook attached to the plough. In the damp hollows of white sand, plantations were established mainly with Oak saplings or 1-year-old Pines. Oak was somewhat stunted up to the age of 30 years, but after 40 years, growth improved and the trees now appear healthy and vigorous. Pine showed medium height growth and is now regarded as good.

In the brown sands the root system was generally more strongly developed, with more frequent branching, while in the white sands a whip-like root system with scanty branching was more usual. In the ploughed soils, roots often occurred massed at one place, particularly at the rootstock, whereas other parts were either root-free or bore only scanty root growth. Changes in the direction of growth were frequent, probably owing to the distribution of nutrients at different levels, lack of oxygen and other limiting factors. The rate of growth of horizontal roots was not improved by soil loosening. Although roots 12–18 m. long occurred, the average length for 30-year-old Pines was about 3 m. However, the formation of auxiliary tap roots with 'fans' or root 'bushes' allowed more intensive penetration into the ploughed soils than into the unloosened soils, where one tap root only is usually predominant.

The number of xylem strands seems to have been influenced more by soil structure than by the provenance of the plant. In young horizontal roots the xylem arrangement is always diarch, but sudden changes may occur as the tree grows older. In the tap roots the number of xylem strands was usually three up to a depth of 15 cm., and thereafter two. 'Fan' and 'bush' roots showed an exclusively diarch formation.

Nutrient analyses of these heath soils generally showed the presence of most of the important nutrients in sufficient quantity to allow satisfactory growth, but only a small percentage of the nutrients present is immediately available to plants. Normal root growth occurs in areas where the physical condition of the soil is better, as in the brown sands, or when the compacted soils are loosened by ploughing. The root systems were better developed in deeply ploughed areas (65 cm., and a further 15 cm. loosened) than in the areas ploughed only to a depth of 45 cm.

In both ridged and ploughed areas development was generally satisfactory in the first few years, but ridge-sown plants began to show signs of decline in the 4th year, and in the ploughed areas reduced growth was evident from the 7th year onwards, particularly between the 10th and 15th years. The Pines in the ploughed plantations had at this time penetrated to the raw humus layer with their vertical roots, and at this stage many of the weaker plants died. On white sand soils, the raw humus layer which has been ploughed under leads to stunting of growth owing to the decay processes developed in it, and even on the best brown sand areas it is harmful to the Pine roots. Except for this effect of the raw humus, the breaking up of the soil has acted very favourably on the development of the root system in all types of soil. Vertical root development was substantially greater and healthier in soils ploughed to a depth of 65 cm. and loosened another 15 cm., than in those which were ploughed to a depth of only 45 cm. Temporary submergence of the vertical roots in ground water does no harm, but a permanently high water-table and a high water content of the soil shorten the growing period.

The formation of fairly large raw humus masses under heath on all types of soil indicates that the soil micro-organisms are either poorly developed or that their activity is restricted. In ploughed soils the better aeration and drainage create conditions better suited for the life and development of soil organisms than are present in unworked areas. Failures in afforestation will undoubtedly occur less often if the raw humus is removed before ploughing and is not ploughed under.

But no matter how carefully the soil loosening and silvicultural work are carried out, productivity cannot be maintained by afforestation with purely coniferous species. It is advisable to include other species such as Oaks, which not only penetrate the soil more thoroughly with their roots but are also less sensitive to ground water and build up better forms of humus than do stands of pure Pine.

23.23. Sowings

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.1 : 12.11.3 (485) : 12.25. Skogsodling och fröproveniens. [**Forest planting and seed provenance.**] *Skogen* 32, 1945 (93–4). [Sw.] [732].

The difficulties of providing adequate and suitable seed from various parts of Sweden for regions of Norrland, where the set is very low or a complete failure, are mentioned. The need is pointed out for the adoption of some basic principles and standards to regulate the use of seed brought from the area of collection to another tract for planting. Spruce and Pine require different regulations in delimiting areas of seed transference.

The practical suggestions in O. Langlet's recent contribution on the subject (published elsewhere) form the basis of the present paper.

Spruce and Pine are separately dealt with and the role of altitude, as well as latitude and longitude, is considered in determining the range of seed transfer. The views expressed are based on experimental results at the Forestry Research Institute (Sweden) and other material, as well as on consultations between the author and L. Tirén and B. Lindquist.

M. L. C. W.

23.23.15 : 12.26–8. Li, Lai-Yung. **The influence of stratification of Tung seeds upon emergence and establishment of seedlings in the nursery.** *N.Z. J. Sci. Technol.* 25, Sect. A., 1943 (43–8). [Plant Research Bureau, D.S.I.R., N.Z.]. O.R.S. [733].

An account of a study made in New Zealand in 1942–3. Field measurements were made on the rate of emergence of Tung seeds and final establishment of seedlings, from non-stratified seeds and stratified seeds stored in moist sphagnum moss at (*a*) room temperature varying from 40° to 60° F., (*b*) 38° F., (*c*) 32° F. Stratified seeds started and completed their emergence earlier than non-stratified seeds, 75 to 95 per cent. of stratified seeds emerging within 3 weeks after emergence first started. Stratification also increased the number of established seedlings. Seeds stratified at 38° F. and 32° F. gave slightly better results than those at room temperature, but no significant difference was found between results at temperatures of 38° F. and 32° F.

23.23.15 : 23.23.19 : 12.26–8. Barton, L. V. **Viability of seeds of *Fraxinus* after storage.** *Contr. Boyce Thompson Inst.* 13, 1945 (427–32). [734].

Tests indicate that the viability of seeds of *Fraxinus excelsior* L. from Westphalia, Germany, and *F. pennsylvanica* Marsh. from New York Botanical Gardens was retained for 7 years by storage in sealed containers at 5° C., seeds of the two species having moisture contents of 10 per cent. and 7 per cent. respectively. By the end of the eighth year the viability of *F. pennsylvanica* seeds was reduced by approximately 50 per cent. and it was lost completely after 9 years of storage.

23.23.19 : 12.25 : 11.11. McCulley, R. D. **Germination of Longleaf Pine seed at high and low temperatures.** *J. For.* 43, 1945 (451–2). [Southern Forest Exp. Sta., Lake City, Florida.] [735].

Earlier experiments have indicated that temperatures much above 80° F. are unfavourable to germination of Longleaf Pine (*Pinus palustris*) seed [see *Occ. Paper Sth. For. Exp. Sta.* No. 78]. In order to make a direct comparison between germination at high and low temperatures an experiment was set up in which samples from each of two lots of seed were cooled with ice to about 65° F. and comparable samples were allowed to remain at laboratory temperatures of 85–100° F. Total germination in 25 days was 49 and 64 per cent. for the two ice-cooled samples of seed and 14 and 18 per cent. for the two samples of seed at laboratory temperatures. Of the seed which remained ungerminated at the end of 25 days, 9 and 24 per cent. of the ice-cooled and 41 and 63 per cent. of seed at laboratory temperature was found to be sound, a further indication of the inhibitory effect of high temperature upon germination of seed of this species.

23.24. Formation of Stands by Planting

23.24 (67.6) : 06.1 : 23.27 : 46. **Kenya Arbor Society: wartime progress report, August, 1943—February, 1945.** Kenya Arbor Society, Nairobi. 1945. pp. 7. [736].

Notes are given of the success or failure of various tree-planting projects of the society. Failure is usually due to drought or to the incursions of Kikuyu herdsmen and their cattle. It is recommended that the planting of roadside

trees should not be carried out until all road-making activities are at an end.

23.24 (81). GONÇALVES, A. P. Silvicultura aplicada. [**Applied silviculture.**] *Ceras, Minas Gerias* 5, 1944 (280–8, 318–25, 404–8). [Port.] Biol. Abstr. 19 (7289). [737].

These papers deal with transplanting of tree seedlings with boxes, preparation of the planting site, setting up markers for lining out and spacing trees, methods of planting, and cultural treatment of plantations.

23.24.2. *Methods of Planting*

23.24.2 : 12.14.3 : 12.11.23 : 12.25. SCHANTZ-HANSEN, T. **The effect of planting methods on root development.** *J. For.* 43, 1945 (447–8). [Univ. of Minnesota.] [738].

In order to study the effect of planting methods on root development, an experimental planting using 2–2 stock of White, Red and Jack Pine and White Spruce was established at the Cloquet Forest Experiment Station, Minn., in 1937; the soil is a medium-fine sand, 6–10 in. deep with a subsoil of medium to coarse sand. Five planting methods were used for each species—the inverted V, the shovel slit method, the regular planting bar, the mattock slit, and careless planting by the slit method. The trees were allowed to grow for two seasons before the excavation of root systems was begun. The differences in root development between the various planting methods was checked statistically using the *f* test, but none was found to be significant. The results might have been different had seedling stock been used or the soil been a heavy clay.

23.24.3. *Spacing*

23.24.3. MULLOY, G. A., and CUNNINGHAM, G. C. **Planning a planted forest.** *For. Chron.* 21, 1945 (127–9). [Dominion Forest Service, Ottawa, Ont.] [739].

A plea for triangular rather than square planting in order to produce a more naturally spaced stand, which will also be easier to thin. A table gives the number of trees per acre at various spacings, both triangular and square. [Cf. *For. Abstr.* 6 (161).]

23.26. Plant Rearing. Nursery Practice

23.26.1. SOUTH AUSTRALIA. **Annual report of the Woods and Forests Department for the year 1942–43.** Govt. Printer, Adelaide. 1944. pp. 11. [740].

Application of a mulch of charcoal screenings on forest nursery beds resulted in a generally better colour and growth of the young plants in the areas treated (p. 4).

23.27. Arboriculture

23.27 : 23.21 : 21 : 23.24. GORDON, G. B. **Committee on roadside development. Report of subcommittee on plant ecology. 'The selection and use of trees on highway areas'.** *Proc. Highway Res. Bd., Wash.* 20, 1940 (523–48). L.S. [741].

A comprehensive report on the basic principles of roadside tree planting in the north-eastern and middle Atlantic region of the United States, with lists of species suitable for the purpose. Successful growth of roadside trees is determined by various factors, including adequate rainfall (at least 18–20 in., well distributed over the year), the availability of a permanent border zone and a suitable type of highway design. Among the factors determining the selection of species are:—(1) suitability of the species to the planting site; (2) availability of adequate nursery-grown stock; (3) resistance of the species to attacks by insects and disease; (4) transplantability; (5) long life; (6) shade-bearing qualities; (7) the absence of showy flowers or fruits likely to encourage vandalism; (8) resistance to wind and storm damage; (9) compatibility with the existing landscape; and (10) ease of maintenance after establishment.

The main objects of tree planting on highways are:—(1) to provide shade where desirable; (2) to accentuate curves; (3) to outline and emphasize fine views from the highways; (4) to soften outlines of bridges and other highway structures and merge them into the adjoining landscape; (5) to screen undesirable views; (6) to control or reduce drifting of snow or sand on to the traffic lanes; and (7) to merge the planted highway into the adjoining open country landscape.

Some of the factors necessary for successful tree planting are discussed and reference is made to the principles governing the planting of street trees in towns. The following tables are included:—

(1) A partial list of common native and naturalized deciduous shade trees for roadside planting.

(2) A partial list of common native small trees for roadside planting.

(3) A partial list of evergreen trees of value for roadside planting.

(4) Some common plant indications: shrubs found along roadsides of the northeast and middle Atlantic States.

(5) Landscape analysis of certain planting sites on roadsides in the northeastern and middle Atlantic region (cut-over or cleared roadsides).

(6) Landscape analysis of certain typical planting sites (woodland roadsides).

In general, only indigenous species are considered suitable for roadside planting.

23.27 (729.5) : 23.21 : 12.26–8. WOLCOTT, G. N. **Trees for roadside planting in Puerto Rico.** *Carib. For.* 6, 1944–45 (115–29). [E.Span.f.] [Agricultural Exp. Sta., Rio Piedras, Puerto Rico.] [742].

An account is given of the species hitherto most used for roadside planting in Puerto Rico, where the provision of shade is very desirable, but where results have been disappointing since almost all the species used are subject to insect attack or diseases. It is suggested that trial should be made of species which have been successfully planted in other Central American countries. These include *Ficus nitida* and *Mangifera indica*, both of which are much used in Brazil. The only objection to the latter is the daily necessity of sweeping up the fallen leaves. *Swietenia mahagoni* is common in towns of Dutch Guiana, and seems to be almost perfect for the purpose, the only disadvantage being its slow growth.

23.27 (82) : 23.21 : 12.26–8. JOZAMI, J. M. Especies más convenientes para arbolar calles y avenidas. **[Tree species most suitable for streets and avenues.]** *Suelo argentino* 4, 1945 (262–3, 269). [Span.] [División Forestal del Departamento de Agricultura y Ganaderiá de Entre Ríos.] A.P.B. [743].

The following species are recommended, with some account of their good points, for street planting:—*Albizzia julibrissin, Acacia visco, Robinia pseudoacacia, Styphnolobium iaponicum, Melia azedarach, Jacaranda acutifolia, Fraxinus americana, Juglans nigra, J. australis, Populus alba* var. *nivea, Ulmus 'campestris'*.

23.3. *Afforestation*

23.3 (54.5) : 12.26–8 : 23.24.2. SINGH, P. **Afforestation of the *belas* in the Punjab.** *Indian For.* 71, 1945 (183–6). [Indian Forest Service.] [744].

Belas are alluvial, riverain wastelands scattered along the banks of the rivers in the Punjab; they are subject to annual or periodic flooding during the rainy season. After floods the fresh alluvium deposits are colonized by pioneer species such as *Tamarix dioica*, Kahi (*Saccharum spontaneum*) and Kana (*S. munja*). After the soil is stabilized these are succeeded by such trees as Kikar (*Acacia arabica*), Phulai (*A. modesta*), Shisham (*Dalbergia sissoo*), and, in lower reaches of the rivers, Poplar (*Populus euphratica*). Most of the Shisham forests on the *belas* are artificially raised, and under very moist conditions Mulberry is coming in naturally under them. Some 80 years ago the *belas* were acquired by Government for raising plantations to meet the fuel requirements of the railways. The replacement of wood by coal as railway fuel largely destroyed the importance of these plantations, but recently, with the great increase of arable cultivation, Forest Officers have once more become interested in them, and in 1940 a start was made on planting *belas* with Shisham stumps, a method which has proved much more satisfactory than direct seeding on irrigated plantations. This method was a failure owing to the very different conditions in the *belas*, and the 'boat-pit' technique was then evolved, which gave excellent results. The stumps are planted at the bottom of elongated shallow pits in spring and watered till the rains break; at the end of the first growing season they produce man-high plants. A detailed account of the method is given; the total cost is rupees 90 per acre. These *bela* lands can grow very fine Shisham and it is proposed to manage the forests on a sufficiently long rotation to produce timber.

23.3 (54.5) : 11.62 : 23.21. KHAN, A. **Afforestation in Attock Soil Conservation Division [Punjab].** *Indian For.* 71, 1945 (147–8). [745].

After a brief review of the soil and climatic conditions in Attock Soil Conservation Division, the author discusses the fundamental principles of present-day afforestation technique (for moisture conservation), including contour trenching, hoeing and contour ridging.

In choosing species for planting, preference has been given to drought- and frost-resistant trees, such as Phulai (*Acacia modesta*), Kikar (*A. arabica*), Mesquite (*Prosopis* sp.), Beri (*Zizyphus* sp.), and Bakain (*Melia azedarach*). Proposals are made for future research.

23.3 (75.4–6 : 76.8) : 12.25 : 23.24. MINCKLER, L. S. **Reforestation in the Spruce type in the Southern Appalachians.** *J. For.* 43, 1945 (349–56). [Appalachian Forest Exp. Sta., Asheville, N.C.] [746].

The original stand of Red Spruce (*Picea rubra*) and southern Balsam Fir (*Abies fraseri*) on some 1,500,000 acres in the southern Appalachians was clear-felled and the land devastated by burning, which destroyed much of the organic soil and was followed by erosion. A certain amount of reforestation has been done, and during the summer of 1938 a field survey was made of plantations and planting sites in the Spruce type as a basis for a programme of research on reforestation of denuded lands. From this study it was ascertained that vegetative competition is a critical factor in the success of plantations, and conditions were determined (*a*) under which planting is possible without special treatment and (*b*) under which some treatment is needed to obtain success. The three major planting sites involved are:—(1) sites with dense herbaceous vegetation; (2) sites with young stands of undesirable, brushy hardwoods; (3) severe rocky sites with very thin soil and sparse vegetation. This report discusses the results of experiments to determine the best methods of successfully reforesting these sites, and makes recommendations based on these studies and on general field observations.

23.5. *Underplanting. Shelterwoods. Nurses*

23.52 (67.6) : 23.21 : 12.26–8 : 42.5. THOROLD, C. A. **Elgon dieback disease of coffee.** *E. Afr. agric. J.* 10, 1945 (198–206). [747].

A detailed account is given of the East African disease of Coffee known as Elgon dieback and an allied condition known as 'hot and cold'. The evidence seems to point to these diseases being of physiological origin, possibly due to lack of carbohydrates. Experiments to find out the effects of shade show conclusively that adequate shade cures the disease and prevents its recurrence. Natural shade proved more satisfactory in every way than artificial shade. The quick-growing species Giant Castor Oil (*Ricinus*), *Vernonia amygdalina* and *V. holstii* are surface-feeders and liable to harm the Coffee in dry periods or on poor soils. The choice of permanent shade trees for the higher altitudes is rather limited. The writer recommends Musembe (*Entada abyssinica*), an indigenous tree but rather slow-growing so that it will not usually give shade in less than ten years from seed. *Acrocarpus fraxinifolius* has proved very satisfactory on Mt. Elgon. *Grevillea robusta*, though a poor shade tree, makes excellent windbreaks, and it has been found that these are effective in reducing die-back, though not as efficient as a uniform overhead canopy.

23.52 (729.5) : 23.21 : 12.26–8. WADSWORTH, F. H. **Forestry in the Coffee region of Puerto Rico.** *Carib. For.* 6, 1944–45 (71–81). [E.Span.f.] [Tropical For. Exp. Sta., Puerto Rico.] [748].

In the production of the shade necessary for Coffee trees, intensive forest regeneration and silviculture are practised. Wildings of Coffee shade trees are transplanted to openings in the canopy, where they will receive sufficient light and eventually produce the desired shade. The shade is so managed that there are always at least two and sometimes three age classes, and the older trees are continually being replaced. When young trees in a new plantation form a canopy, they are pruned regularly to maintain proper density of shade. Later, thinnings are made if necessary. The ideal Coffee shade tree is short, with a spreading umbrella-like crown providing uniform density of shade over a wide area, and the trees are spaced as wide apart as the requirements of continuous canopy will permit.

Leguminous trees have always been used on account of their nitrogen-fixing properties. The two species most used in the past have been Guaba (*Inga vera*) and Guamá (*I. laurina*), but they are not wholly satisfactory, since both are attacked by ants (*Myrmelachista ambigua ramulorum*) which damage the twigs and eventually attack the Coffee. Moreover, Guamá is difficult to manage after it becomes old and Guaba, even when young, is usually attacked by a bacterial wilt which causes dieback in the twigs. A number of *Inga* species were introduced from Venezuela in 1927, and two of these, *I. fastuosa* and (?)*I. punctata* appear to be in every way satisfactory. Both

grow rapidly but not tall and so far show no indication of attack by ants or the wilt. The wood of these two species is apparently at least as useful as that of Guamá and Guaba and makes excellent charcoal. Natural regeneration of *I. fastuosa* is not plentiful, but that of (*?*)*I. punctata* is very abundant.

23.52 (86) : 23.21 : 12.26–8. URIBE, L. U. Arboles de sombrio de los cafetales en Colombia. **[Coffee shade trees in Colombia.]** *Carib. For.* 6, 1944–45 (82–4). [Span.E.f.] [749].

In its native habitat Coffee has been commonly raised without shade, which was first used in Central America and was found to prolong the life of the plantation, increase the yield, and improve the quality of the fruit. In Colombia, Banana (*Musa*), spaced 6 m. apart, is used as temporary shade in new plantations. For permanent shade various species of *Inga* are used. The most common is *I. edulis*, which has an umbrella-like crown, is not attacked by parasites, and is long-lived. Other good species are *I. ingoides*, *I. fredoniana*, *I. duquei*, *I. spuria*. *I. densiflora*, and *I. chartana* have been used, but they are not to be recommended on account of their more compact crowns. Possibly useful species not yet tried are *I. interfluminensis* and *I. sierrae*. It has been found that the most useful species of *Inga* are those having cylindrical and striated pods. They live longer, are immune to parasites, and possess wide, spreading crowns.

24. TENDING OF STANDS AND TREES

24.2. *Thinnings*

24.25 : 12.25 : 11.15 : 12.11.12 : 12.14.5. SAVINA, A. V. Izuchenie vliyaniya rubok ukhoda na svetovoy rezhim i energiyu assimilyatsii v sosnovom nasazhdenii. **[Research on the influence of thinnings on the light régime and rate of assimilation in a Pine plantation.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 21, 1941 (5–29). [Russ.russ.] [750].

Near Moscow, in a 14-year-old stand of *Pinus sylvestris* (transition from *Pinetum vacciniosum* to *P. myrtillosum*) with 5,000–5,500 trees per ha., mean height 4·5 m. and mean diameter 5·5 cm., observations were made on two plots thinned to remove 15 per cent. and 24 per cent. of the volume respectively, and on an unthinned control. Light intensity recorded 3 times daily during the period after thinning showed that: (1) light diminished gradually in the control plot and was 1·5 to 2 times lower after a fortnight; (2) in the lightly thinned plot (which started with the lowest intensity of light) light intensity increased by 3 to 4 times at soil level and 3·5 to 4·3 times at a height of 1·5 m.; (3) in the heavily thinned plot (which started with the highest intensity of light) the intensity increased by 3·7 to 4·7 times at soil level and 4·5 to 5·7 times at 1·5 m.

The quantity of foliage per tree varied directly with the stem diameter. Needle weight as a percentage of the weight of a whorl decreased as the age of the branch increased, owing to shedding of older needles. A similar decrease occurred with increase in height of the whorl, owing to greater development of wood with better illumination.

Well illuminated branches had 55 per cent. of their weight in foliage, while branches growing in the shade had 75 per cent. of their weight in foliage. Of the total foliage, 16·3 per cent. was of the current year (incomplete), 36·2 per cent. of the 2nd, 30·3 per cent. of the 3rd, 15·4 per cent. of the 4th, and 1·8 per cent. of the 5th years. The several exposure types were directly correlated with stem diameter, the biggest stems bearing the most shade-grown foliage. The greatest concentration of foliage occurred in the middle (6th to 8th) whorls where needles of all three exposure types were represented. Needles growing in light were larger than those growing in shade. Expressed as area per tree, foliage area increased in direct proportion to stem diameter; expressed as area per kilogram of foliage, the greatest area occurred in the 5–6 cm. diameter class.

Second-year foliage had a higher rate of assimilation than foliage of the current year. The rate of assimilation was 1·5–2 times as much in well illuminated as in more shaded needles; in total shade it was nil. Thinnings had no significant effect on the assimilation rate, for the first fortnight at least.

24.3. *Opening of the Canopy. Release and Improvement Fellings*

24.31 : 12.25 : 56. BULL, H. **Increasing the growth of Loblolly Pine by girdling large hardwoods.** *J. For.* 43, 1945 (449–50). [Southern Forest Exp. Sta., New Orleans, La.] [751].

[Cf. *For. Abstr.* 1 (167).] The results are

given of a second 5 years of study on the beneficial effect of girdling hardwoods on the mortality and growth of Loblolly Pine (*Pinus taeda*), the present account being concerned only with those Pines within 15 ft. of hardwoods that were more than 9·5 in. d.b.h. in 1933—i.e. those that were cut or girdled in one sample plot and left untouched in the second (control). Twice as many Pines have died during the 10-year period in the control plot as in the improved plot. Average 10-year d.b.h. growth of the surviving Pines in the improved plot is nearly 3 times as great as in the control plot. Basal area was approximately the same in the two plots in 1933 but is now nearly twice as great in the improved plot as in the control plot, which actually had a net loss in basal area over the 10 years. The improved plot has produced 2·86 cords more than the control plot and its pulpwood volume has increased 3·6 times faster. All the girdled hardwoods (Sweetgum, Blackgum, Winged Elm and various species of Oak) died within 38 months, and none of them had living sprouts five months after girdling.

24.31 : 07.7 : 44.1 : 97.3. Long, H. K. **The Cornell tree stabber in South Africa** [*sic*]. *J. For.* 43, 1945 (286–7). [752].

The writer describes his use of the Cornell tree-stabbing tool to poison weed trees on a ranch in Colombia, S. America. It was found to be much more effective than any other tool or combination of tools. The poison used was 12½ kilos of caustic soda dissolved in 20 gals. of water to which was added, little by little, 50 kilos of white arsenic (As_2O_3). The heated solution was later diluted to 150 or 200 U.S. gals. in 3 or 4 50-gal. drums. Trees were frilled as low as possible and the poison inserted by blows of the stabber. To get rid of the dead trunks the field was burned over during the next dry season after the poisoning, and the stumps were removed.

24.4. *Shelterbelts. Windbreaks*

24.4 (52). Ito, R. **Types and functions of 'Yasiki-mori' (forest in farmyard) on the Musasino Upland, Western Suburb of Tokyo.** *Geogr. Rev. Japan* 15, 1939 (624–42, 672–85). [Jap.e.] *Abstr.* in *Jap. J. Geol. Geogr.* 18 (3), 1941 (35). [753].

A study was made of shelterbelts round farmhouses in several Japanese villages. The trees most used are evergreen Oaks (*Quercus* spp.), Cedar and Bamboo. Their purpose is to give shelter from prevailing winds, dust storms and fires and to provide timber for building construction and tool handles.

24.4 (73) : 11.62.11 : 23.24. Williams, R. A. **A quarter-billion trees against the wind.** *Timberman* 46 (6), 1944–45 (62–3, 65). [U.S. Great Plains Regional Forestry Division, Lincoln, Neb.] [754].

Between 1934 and 1942 the United States Forestry Service planted 18,599 miles of shelterbelt under the Prairie States Forestry Project. Survival varied between 70 and 80 per cent. and only 901 miles were abandoned as unsuccessful. During the same period the Soil Conservation Service planted 53,011,200 trees in the same area and since 1942 has continued to assist farmers with their planting programmes. These two Federal agencies were together responsible for planting 273,836,400 trees in the 6 Great Plains states, and more than 5 million more trees were planted in 1943 and 1944 in the Great Plains in Soil Conservation Districts. Lack of manpower has been partly compensated by the use of tree-planting machines developed before the war. A three-man crew can plant ½ mile of shelterbelt in an afternoon at the rate of 1,000 trees an hour. Careful checks on the comparative survival of machine-planted and hand-planted trees show a slightly better survival for the former. No substitute has been found, however, for the 3 to 5 annual cultivations that the farmer must perform on each planting for the first 5 or 6 years. When cultivation is neglected, the rate of growth is greatly retarded and, on the more difficult sites, complete failure may result.

A tentative Forest Service and Soil Conservation Service check-up in 1944 showed that after 9 years, Cottonwood trees (*Populus* spp.) have attained heights of from 30 to 50 ft.; Pine are 24 ft. high in 5 seasons. Growth has slowed up in many of the younger belts where shortage of labour has not permitted full cultivation, but survival is still excellent.

3. FOREST UTILIZATION. FOREST TECHNOLOGY.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31.0. *General Information on Woods*

31.0 : 12.26–8 (94) : 12.19. **The properties of Australian timbers: Brown Tulip Oak (*Argyrodendron trifoliatum* (F. v. M.) Edlin syn. *Tarrietia argyrodendron* Benth.)** *Mon. News Lett. Div. For. Prod. Aust.* No. 138, 1945 (6–7). [755].

31.0 : 02.1. **Some reference books on domestic and foreign woods.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1479, 1945. pp. 13. P.R. [756].

The books and pamphlets describe the characteristics, occurrence and uses of various woods. The references are grouped by countries or regions, and are in chronological order within each group, the most recent placed first.

31.0 : 12.25 : 12.19. BRUSH, W. D. **Foreign woods: Brazilian Araucaria ('Parana Pine') (*Araucaria angustifolia*).** U.S. Forest Service, Washington, D.C. 1945. pp. 11 + map. P.R. [757].

An account is given of the properties, principal uses, geographical distribution, and site requirements of *Araucaria angustifolia*. The present total stand is estimated at 200 to 300 billion bd. ft., quantities of commercial importance being confined to the extreme south of Brazil. The total exports of this timber between 1915 and 1943 and details of imports by specified countries between 1935 and 1943 from Brazil are tabulated.

31.0 : 12.26–8 : 12.19. BRUSH, W. D. **Foreign woods: Teak (*Tectona grandis*).** U.S. Forest Service, Washington, D.C. 1945. pp. 13 + map. P.R. [758].

A revision of the pamphlet noted in *For. Abstr.* 1 (172).

31.0 (66.2–67.2) : 12.26–8. **Timbers of West Africa.** Timber Development Association Ltd., 75 Cannon Street, London, E.C.4. 1945. pp. 80 + map. [759].

Part one of this booklet deals with timbers of British West Africa, and part two with those of French West Africa. Information given for each species includes common trade names, with vernacular names, scientific names, general characteristics, seasoning, strength, durability, and working qualities, uses, and supplies.

31.0 (82) : 33.8. TORTORELLI, L. A. Las maderas argentinas en la industria aeronautica. **[Argentine woods in the aircraft industry.]** *Publ. téch. Direcc. for. Minist. Agric. Argentina* No. 1, 1945. pp. 21 + plates. [Span.] [760].

The writer concludes that there exist, in the cold to temperate region of the Patagonian Andes, timbers suitable for the aircraft industry, which will bear comparison with those imported species now in general use. The basic timbers of the Argentinian aircraft industry should be Araucaria de Neuquén (*Araucaria araucana*), Guindo Fueguino (*Nothofagus betuloides*), and Lenga (*N. pumilio*). The Dirección Forestal, a technical organization recently set up in the Ministry of Agriculture, will undertake measures for the protection, improvement and extension of Argentine forests and continue scientific studies of native timbers.

31.1. *Structure. Anatomy. Identification*

31.1 : 31.21.3 : 12.25–8 : 12.11.23. PRIESTLEY, J. H. **Observations on spiral grain in timber.** *Amer. J. Bot.* 32, 1945 (277–84). [Leeds Univ., Leeds.] O.B.D. [761].

As a result of an opportunity to study certain cases of spiral grain in hardwood trees (*Sambucus nigra, Syringa vulgaris, Castanea sativa*), fundamental differences were found between the structural features in hardwoods and softwoods. In hardwoods, spiral grain is the result of a twist given to the trace system and cambium cylinder in the primary axis; the spiral inclination thus given to all secondary vascular elements persists throughout radial growth and is therefore accentuated each year by the geometrical results of expanding the spiral with the increasing girth of the woody axis, though the files of wood elements still complete the circuit of the axis in the same longitudinal distance.

By contrast, in the softwood the so-called spiral course of the wood elements is really fictitious. In the first-year wood the grain is always straight, the inclined course of the wood elements arises during the second or later years; it is due to a tilt given to the cambium initials, which results in the originally vertical elements

in the radial files becoming tilted but not otherwise altering their position. There is no sense in which any file of elements, traced longitudinally, completes a circuit of the axis; and the gradual change in tilt of the elements, which occurs in later years, has no direct connexion with the increasing girth of the axis. On the other hand, a close correlation exists between the occurrence of the so-called spiral grain in the softwood and the occurrence of excentricity in the radial increment. The position of maximum thickness in any excentric cylinder of wood added to an upright softwood axis has recently been shown to follow a spiral course along the length of the axis and it is shown that this phenomenon adequately accounts for the development of a tilt in the fusiform initials of the cambium. If the position of maximum thickness follows a left-handed spiral course in the axis, the tilt imparted to the wood elements gives the appearance of left-handed spiral grain; if the position of maximum thickness follows a right-handed course the tilt to the wood elements suggests a right-handed spiral grain.

In order to assist in a fuller realization of the fundamental differences, it is suggested that it would be helpful to restrict the term 'spiral grain' to the phenomenon in hardwoods and describe the grain now called spiral in the soft-woods as 'tilted grain'. *Author's summary.*

31.1 : 24.36 : 12.26–8. SAVINA, A. V. Vliyanie rubok ukhoda na stroenie drevesinȳ duba. **[The influence of thinnings on wood structure in Oak.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 21, 1941 (137–44). [Russ.russ.] [762].

The study of wood samples taken from trees of different ages (27–80 years) and Krafft dominance classes, in two forests that had been thinned 5 and 6 years previously, showed that: (i) Thinning resulted in increased length of wood fibres, the greatest increase (20 per cent.) occurring in trees of class III; fibre length also increased in unthinned trees of the control area, but to a relatively small extent. (ii) Tracheids increased in length after thinning, most in trees of classes III (18 per cent.) and V*a* (21 per cent.). Vessel elements in the same classes increased in length by 15 and 16 per cent. respectively. Tracheids and vessels in control trees showed little change. (iii) Thinning resulted in more mechanical tissue per annual ring, particularly in classes I and III (6–7 per cent.). (iv) Width of annual rings was greater after thinning in classes I–III (11·4, 17 and 15 per cent.); class IV was unaffected, while class V and controls showed decreases. The increase of thick-walled summerwood after thinning improves the quality of the wood.

31.1 : 12.26–8 (59.1). CHOWDHURY, K. A. **The identification of Burma commercial timbers.** *Indian For. Rec. (n.s.) Utilization* 3 (6), 1945. pp. 27 + plates. P.R. [763].

Brief notes on general timber structure and properties illustrated by photographs. A key for identification of commercial timbers, descriptions of gross structure and photomicrographs of 30 species found in Burma are provided in replacement of *Burma For. Bull.* No. 30 (1932).

31.2. *Physical Properties*

31.2 : 12.26–8 (81). ARMSTRONG, F. H. **Mechanical and physical properties of some Brazilian timbers.** D.S.I.R. Forest Products Research Laboratory [Melbourne]. 1945. pp. 9 + plates. [764].

Tests were made, and results tabulated, of the mechanical and physical properties of eleven species of Brazilian timbers in order to assess their general usefulness, and particularly their suitability for use in the under-framing of motor vehicles as substitutes for Burma Teak. Experimental data are given for each species separately and in some cases compared with data for Oak, Gurjun (*Dipterocarpus* spp.), Teak and Central American Mahogany. The timbers fall roughly into two classes: (*a*) those suitable for all constructional work where Oak and Gurjun are normally used, viz: *Aspidosperma desmanthum*, *Goupia glabra*, *Tecoma* (Ipe), *Cariniana* (Red Jequitiba), *Qualea* (Mandio), and *Aspidosperma polyneuron*; and (*b*) those suitable only for light constructional work or as direct substitutes for Burma Teak, viz: *Cedrela* spp., *Cordia goeldiana*, *Paratecoma peroba*, *Ocotea rubra* and *Vochysia* (Red Quaruba).

31.22. Relation to Water, Air, Gases

31.22.1 : 33.53 : 12.25. LUMDSEN, G. Q., and HEARN, A. H. **Methods for the determination of moisture content of Southern Pine round timbers.** With discussion. *Proc.*

Amer. Wood-Pres. Ass. 40, 1944 (126–38). [765].

Comparative tests were made of 5 methods of determining moisture content: (1) by oven-drying discs cut at 5 ft. intervals along the pole, (2) by toluene-drying borings taken from the outer 2 in. of the pole, (3) by calculation from weight-density data on discs cut at 5 ft. intervals along the pole, (4) by calculation from weight-density data on discs cut from the butt and top ends of the pole, (5) by measuring the electrical resistance of the pole, using the 4-electrode formula. The results of the tests are described and it is suggested that method (2) is best suited to commercial practice, having the advantages of speed, simplicity, flexibility and accuracy. It is particularly applicable to poles with a moisture content of 35 per cent. or less.

31.22.2 : 33.36.3. MacLean, J. D. **Effect of direction of growth rings on the relative amount of shrinkage in width and thickness of lumber and effect of radial and tangential shrinkage on dimensions of round timbers.** *Mimeo. U.S. For. Prod., Madison* No. *R*1473, 1945 (pp. 10 + plates). P.R. [766].

A discussion of the theoretical considerations involved in the determination of the relative amount of change in width and thickness which may occur when moisture changes take place and the annual rings make various angles with the surfaces of sawed material. The formulas developed will be found convenient to use in determining the approximate change in width and thickness when lumber or pieces having moderately small cross-sectional dimensions are seasoned and the average slope of the rings is known. Data of the effect of radial and tangential shrinkage on the dimensions of round timbers are also included. *From author's summary.*

31.23. Specific Gravity

31.23 : 07.7. Paul, B. H., and Baudendistel, M. E. **A field method of determining specific gravity by use of increment cores or auger chips.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1587, 1943. pp. 5 + plates. P.R. [767].

A core is extracted from a log or tree trunk by means of a standard increment borer. Length is measured when green; the core is then dried to a moisture-free condition and the specific gravity is determined by means of a special equipment in terms of its oven-dry weight and volume when green. The equipment and its use, preparation of weight scale, calibration of the spring, preparation and reading of the specific-gravity chart, are described in detail, and illustrated diagrammatically.

31.24. Calorific Value

31.24 : 12.26–8 (82). Calorimetria y rendimiento de leñas de maderas argentinas. **[Heating values of Argentine fuelwoods.]** *Maderil* 17 (199), 1945 (14). [Span.] [768].

A table showing the specific weight, temperature of ignition, calorific values, and thermic equivalents in terms of gas-oil and coal, of 15 Argentine woods of 9 genera (*Schinopsis, Aspidosperma, Astronium, Caesalpinia, Piptadenia, Prosopis, Acacia, Gleditsia* and *Bumelia*).

31.27. Mechanical Strength

31.27 : 01.4. Australia. **Eighteenth annual report of the Council for Scientific and Industrial Research for the year ended 30th June, 1944.** Govt. Printer, Canberra. 1944. pp. 78 [769].

An investigation involving the testing of some 10,000 Izod specimens was undertaken to find out the effect on Izod value of such factors as variation in size of specimen and length of moment arm, notching, and shape of notch. Variation in Izod value with width of specimen has been shown to be linear, while variation with depth appears to be best represented by a cubic equation.

Using the thinnest specimens, the Izod value was found to be constant over a range of moment arms, with a rapid rise in value as the length was reduced beyond a certain point. As the depth of specimen was increased, the range over which the Izod value remained constant was reduced until a depth was reached for which the results showed a definite minimum value. The weakening effect of notching was marked in the case of brittle timbers such as Hoop Pine (*Araucaria cunninghamii*) and King William Pine (*Athrotaxis selaginoides*), but in the case of tough timbers such as Mountain Ash (*Eucalyptus regnans*), Spruce, and Queensland Maple (*Flindersia brayleyana*) no significant effect due to notching was observed.

31.27 : 38.2. THUNELL, B. Några hållfasthetsundersökningar med trävirke ur gamla byggnadsverk. [**Some investigations of strength carried out with wood from old structures.**] *Medd. svenska TräforskInst.* No. 2, 1945. pp. 2. [Sw.sw.] *Repr.* from *Trävaruindustrien* No. 1, 1945. P.R. [770].

Tests were conducted with deal (and in one instance with Beech) which had been under water for periods varying from 20 to 300 years, roof-truss timber 300 years old, and framework and wall timbers 70 years old. The results indicate that in no case had any appreciable reduction in strength occurred.

R. P. J.

31.27 : 33.15 : 12.26–8. HUNT, P. J., GOODELL, H. R., and PHILLIPS, R. S. **Bolt-bearing properties of wood and modified wood. Bolt-bearing strength of laboratory-made cross-banded Yellow Birch compreg under aircraft bolts.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1523A, 1945. pp. 13 + plates. P.R. [771].

In the tests described, steel aircraft bolts were used and the compreg was made of Yellow Birch veneers impregnated with water-soluble phenol-formaldehyde resin, bonded without the use of additional adhesives. The preparation of the specimens, the tests applied to them, and the results obtained are fully discussed; a series of photographs shows the apparatus used. The ultimate bolt-bearing stress of cross-banded compreg was approximately 34,000 lb. per sq. in. under $\frac{1}{4}$-inch bolts, 30,000 lb. per sq. in. under $\frac{1}{2}$-inch bolts, and 28,000 lb. per sq. in. under 1-inch bolts.

31.27 : 31.8. LIMBACH, J. P. **Compression failures in wood detected by the application of carbon tetrachloride to the surface.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1591, 1945. pp. 1–3 + plates. P.R. [772].

When carbon tetrachloride, which evaporates quickly leaving the surface unchanged, is spread over a wood surface containing compression failures, it renders them more apparent. Seen from above these failures appear bright when light at a low angle strikes directly along the grain, and dark when it strikes at right angle. Photographs of compression failures in Sitka Spruce are included. It is believed that the use of this clearing agent should be of considerable value in the detection and elimination from aircraft construction of wood whose strength is weakened by incorporated compression failures.

31.3. *Chemical Properties*

31.3 : 12.25. WISE, L. E. **Quantitative isolation of hemicelluloses from coniferous woods.** *Industr. Engng. Chem.* (*Anal. Ed.*) 17, 1945 (63–4). P.R. [773].

Wood of Douglas Fir and Redwood was partially delignified by an aqueous acetic-acid solution of sodium chlorite, the chlorine dioxide of which removes a large part of the lignin without seriously affecting the cellulose or hemicelluloses. The summative results obtained with unextracted woods are:—

	Redwood, per cent.	*Douglas Fir, per cent.*
Lignin	31·30	25·80
Alcohol extract	21·83	4·20
Water extract on residue from alcohol extraction	1·80	3·20
α-Cellulose (corrected for ash and lignin)	35·75	50·09
Hemicelluloses (corrected for ash)	9·63	15·10
Acetyl	0·28	0·76
Total	100·59	99·15

Acetyl values on extracted wood, but calculated on the basis of unextracted wood, are included because these groups are removed during hemicellulose isolation. The final fibrous residue is α-cellulose. The sum of the various fractions (corrected for ash) gives the hemicellulose content of the unextracted wood. The work is being extended to other conifers.

31.4. *Durability. Decomposition*

31.4 : 12.25 : 31.27. NEUBAUER, L. W. **Durability of Redwood boards.** *Agric. Engng., St. Joseph, Mich.* 26, 1945 (203). L.S. [774].

One Douglas Fir, one White Fir and eight Redwood boards were set on end 24 in. deep in loamy soil and tested for durability over a period of 12 years at Davis, Calif. The specimens were watered at intervals during the first three summers to accelerate decay and termite action. The Douglas Fir board failed after three years and the White Fir after four years, both being badly decayed. The Redwood boards endured for the full twelve years but showed various effects from termites and

weathering. Strength tests of these boards showed that light grades had the best appearance while the heavy and clear grades had greatest strength. Sapwood was relatively weak in all cases. Comparison was made of top, middle and bottom sections of the boards: termites and fungi had little effect on top and middle sections but weakness developed a few inches below the ground level.

31.42. Attack by Plant Organisms

31.42.1 : 33.36.1 : 33.31. KIND, A. **The acid production of fungi and its effect on wood impregnated with $CuSO_4$.** *Bull. schweiz. elektrotech. Ver.* 35, 1944 (174–6). Sci. Abstr. B. 47, 1944 (1650). P.R. [775].

From results of various investigations into the conditions necessary for the growth of wood-attacking fungi and the efficacy of $CuSO_4$ as a protective impregnating material, it is shown that, while copper compounds are in general good fungicides, they are sometimes ineffective against certain fungi, particularly those which produce oxalic acid.

31.42.11 : 12.26–8 : 31.8 : 32.25.3–4. ANKUDINOV, A. M. Fautnost' i metodȳ ratsional'noy raskryazhevki osinȳ. **[Defects and methods of rational cross-cutting of Aspen.]** *Lesnaya Prom.* No. 9, 1944 (8–12). [Russ.] [776].

The proper grading of Aspen (*Populus tremula*) timber must take into account all kinds of rot and defects. The most frequent rots in Aspen are caused by *Fomes igniarius* and *Armillaria mellea*. Other kinds of degrade are caused by various saprophytic fungi developing in wood already dying from physiological causes. Red discoloration often affects Aspen wood but is of independent origin.

In spite of the presence of rot in heartwood and sapwood, there is usually much sound wood outside the diseased parts, which careful cross-sawing and trimming can render utilizable with minimum loss. The *F. igniarius* heart rot occurs in the upper part of the bole and is not connected with the butt rot due to *A. mellea*; the latter seldom occurs alone. The presence of fructifications is not sufficient to condemn the log on which they occur. Of samples of heart-rot damage examined, 54 per cent. had fructifications and all these yielded some sound timber. In 84 per cent. of the samples the existence of heart rot was indicated by external signs, which are: fructifications of *F. igniarius*, 'tobacco', and porous-spongy branches and twigs; the third sign is generally but not always reliable. Mechanical injuries form a poor indicator of rot (only 12 per cent. of injured samples showed heart rot).

To estimate the extent of penetration of heart rot, a distance of 1·2 m. below and of 0·8 m. above the extreme limits of a source of infection may be taken as diseased. From the position of the evident fructifications and the other indicators ('tobacco' and porous-sponginess) the concealed spread of rot can be mapped out. Heart rot is usually limited to the upper bole above 6 m., i.e. the zone of dead branches, and seldom occurs in the base from ground level to 3 m., i.e. the zone of mechanical injuries; between 8–11 m. is the most affected zone and here there is a concentration of 'tobacco' and porous-spongy branchlets.

Butt rot (*A. mellea*) extends up to 1–1·5 m. with a small transverse spread; above this level, wood is sound up to the point at which *F. igniarius* rot begins.

By rational cross-sawing, the wood from an Aspen tree can be classed as quality I (sound), quality II (with some rot and suitable for use in match factories) and quality III (for fuel), when both types of rot are present and the whole bole is covered with fructifications.

31.43. Attack by Animal Organisms

31.43 : 13.2 : 33.36.1 : 33.31. HUNT, G. M., and SNYDER, T. E. **An international termite exposure test—fifteenth progress report.** With discussion. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (223–39). [U.S. Forest Products Laboratory, Madison, Wis.] [777].

31.43 : 13.2. RUIZ CASTRO, A. Insectos xilófagos: cuatro coleópteros de la madera labrada. **[Xylophagous insects: four Coleoptera which attack worked wood.]** *Bol. Patol. veg. Ent. agríc.* 11 [1943?]. pp. 201–39. [Span.] R.A.E. 33A, 1945 (167–8). [778].

Structural timbers and wooden furniture in Spain are attacked by the Cerambycids, *Stromatium fulvum* Villers (*unicolor* Ol.), *Hylotrupes bajulus* L., and *Hesperophanes cinereus* Villers, and by *Anobium punctatum* Deg. The author reviews the synonymy, distribution (with particular reference to Spain), and morphology of various stages of these beetles, gives a key to the larvae, also distinguishing them from those of *Xestobium*

rufovillosum Deg., and Buprestids, and discusses the life history and diverse feeding habits of various groups of Longicorns. He then gives notes, based largely on the literature, on the bionomics of the four beetles first mentioned, and a review of the measures employed for their control in various countries. All of them attack trees of various kinds as well as worked wood, though *Hylotrupes* and *Anobium* are restricted to dead or dying wood. *Hylotrupes* is furthermore almost entirely confined to coniferous softwoods, while the others are most injurious to hardwoods, though *Stromatium* has also been recorded as attacking softwoods. In houses, *Hylotrupes* therefore occurs chiefly in structural timbers, while the others mostly bore in furniture. The three Cerambycids develop slowly, the life cycle in Spain usually lasting three or four years for *Stromatium* and *Hylotrupes* and two or three for *Hesperophanes*. *Anobium* develops in a year in temperate climates, requires two years in cold ones and produces two generations a year in hot climates.

31.44. Injury by Chemicals

31.44 : 31.27 : 12.25. LUXFORD, R. F., and KRONE, R. H. **Chemical stain in Noble Fir as related to strength.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1329, 1943. pp. 6 + plates. P.R. [779].

Investigations were made to determine the effect of chemical stain on the strength properties of Noble Fir. The stain is apparently caused by coloured materials present in the wood, which are carried towards the surface during the drying process. The results of the tests made show that this stain may cause a slight decrease in shock resistance but not enough to make the material unsuitable for the manufacture of aeroplanes. Noble Fir dried in accordance with the AN–W–2a specification may be used without discrimination between chemically stained and unstained boards.

31.8. *Quality and Defects of Timber*

31.8 : 12.25 : 12.11.3. FIELDING, J. M. **Cone holes in Monterey Pine.** *Leafl. Commonw. For. Bur. Aust.* No. 55, 1945. pp. 7 + plate. [780].

In test runs of 6 × $\frac{7}{8}$ flooring of Monterey Pine (*Pinus radiata*) at Mt. Burr sawmill in 1939 it was found that 24 per cent. of the degrade was due to cone holes, the importance of which as defects in Monterey Pine boards is due to the following characteristics of the species:—

(1) On plantation trees most of the cones are borne on the trunks.

(2) The cone is stalked, and the pressure of growth of the trunk, acting on the base of the cone, fractures the stalk at its connexion with the stem tracheids. Then, as the cone is pushed outwards, the stalk causes a hole in the wood of the trunk.

Although some cones fall, most of them are held on the trunk for many years, usually until they rot. Cones occur mainly at heights between 20 and 60 ft.; those on the basal 20 ft. of the trunk can be removed during pruning, but it is in logs above 20 ft. that cone holes are most prevalent and it seems clear that the only effective control in this zone is by indirect means, and that the only real possibility of reducing the defect lies in the selection and promotion of strains which produce few cone holes, either because they bear few trunk cones or else soon shed them. This point should be borne in mind in the collection of seed, the selection of seed trees and the selection of strains for vegetative reproduction.

31.8 : 31.27 : 12.25 (485). THUNELL, B. Inverkan av vissa kvalitetsbestämmande faktorer på hållfastheten mot böjning hos svenskt furuvirke. [**Influence of certain qualitative factors on the bending strength of Baltic Redwood.**] *Medd. Svenska TräforskInst.* No. 1, 1944. pp. 16. [Sw.e.] *Repr.* from *Trävaruindustrien* No. 24, 1944. P.R. [781].

An account of tests carried out by the Swedish Government Testing Institute and the Wood Technology Department of the Swedish Forest Products Research Laboratory on the effect of knots on the bending strength of Baltic Redwood (*Pinus sylvestris*) joists of four different dimensions and two different groups of knot ratios at a moisture content of 15 per cent. and at fibre-saturation point. The joists were tested for bending at room temperature by four-point loading, and the theoretical span was always 1 ft. less than the entire length of the joists. The load was increased by approximately 400 lb. per sq. in. per minute until a fracture occurred. Small clear specimens tested by loading at two points were used as controls. Data are given on the bending strength, the stress at the limit of proportionality, and the modulus of elasticity.

31.8 : 12.25 (68) : 31.2 : 98.3. SCOTT, H. H. **A comparison between locally-grown and imported softwood timbers.** *J. S. Afr. For. Ass.* No. 12, 1944 (37–51). [782].

In normal times South Africa's timber requirements are largely met by importation; owing to war-time interruption of Empire and foreign trade the country is to-day dependent largely on locally grown conifers. The paper describes the main imported and locally grown woods and compares their merits and limitations. Owing largely to immaturity, much local produce is not up to the standard of the imported material, though in some grades it compares favourably. The importance of grouping local species for such comparison is stressed and the causes of major defects in both classes are discussed. With more intensive pruning and improved methods of conversion and grading, the demand for South African softwoods at maturity should rival that for most classes of imported timber. *From author's summary.*

31.8 : 12.25 (79.4) : 52.43. ROBINSON, G. P., and SANFORD, L. W. **Defects in California Red Fir.** *J. For.* 43, 1945 (439–40). [Southern Pacific Land Co., Sacramento, Calif.] [783].

From a field study made in Sierra County, California, it was found that defect in Red Fir (*Abies magnifica*) averages 4 per cent. of the volume-table figures for limby tops likely to be left on the ground, 3 per cent. for shake, and 1 per cent. for breakage. Additional deductions must be made for trees in which there is butt rot.

32. HARVESTING OF WOOD. LOGGING

32 (485) : 07.7 : 82. FLODMAN, B. **Technical studies in logging in Sweden during the war.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 765 (B–1), 1945. pp. 3. [Sandvikens Jernverks Aktiebolag, Sandviken, Sweden.] [784].

This leaflet is a summary of what has been done in Sweden during the war towards the rationalization of logging. Tools have undergone certain improvements in quality and standardization, and greater use is being made of the bucksaw. Central tool shops are being set up at many places, where woods workers can get their saws filed and their axes sharpened, since it has been found difficult to teach them to do this adequately for themselves. Experiments are being made for the production of a power saw for felling and cross-cutting, and of a transportable barking machine for pulpwood. Intensive studies have been made to get a just system of setting piece-work rates for cutting, and tables have been prepared as a guide in deciding how much work will be required for lopping, barking, etc., in cutting a given tree. A Research Laboratory for Industrial Physiology (Arbetsfysiologiska Undersökningen) has been set up to ascertain the timber cutter's expenditure of energy, the amount of energy required for each individual operation, the kind of food required and the optimum length of working period. A motor truck exclusively intended for log-hauling has been designed.

32 (71) : 07.7. GODWIN, G. **Logging mechanization.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 769 (B–1), 1945. pp 6. [785].

This paper gives reasons why a co-ordinated effort is necessary in attempting to apply mechanical logging methods, and presents a plan for this purpose prepared by the Mechanization Committee of the Association. A summary is given of the mechanical logging equipment at present owned and operated by the member companies of the Canadian Pulp and Paper Association.

32.1. *Marking of Trees and Coupes*

32.1 : 07.7. LE SUEUR, A. D. C. **Timber scribes.** *Quart. J. For.* 39, 1945 (117–9). [786].

A brief illustrated discussion of various types of timber scribe with comments on their relative efficiency for marking thick-barked trees.

32.2. *Felling and Related Operations*

32.24 : 12.26–8 (82 : 89) : 21 : 34.24. JANIS, D. C. **Production of industrial Quebracho.** *Economic Geography* 21, 1945 (145–51). O.G. [787].

The name Quebracho is used for several different species of different families. The most important is Quebracho Colorado (*Schinopsis lorentzii*), the main tannin-producing species. This species grows throughout the Paraguayan Chaco, an area of 9½ million acres, and in the Argentine Chaco. The best stands are found where the temperature is seldom above 105° F. or below 32° F., and on

sites which are sometimes flooded but not swampy. Moisture requirements are exacting, Quebracho rarely being found on dry sites or in permanent swamps. Dense growth is found only in places where ground water is strongly impregnated with salt. The rainfall in the Gran Chaco is 30 to 40 in. in summer and 20 to 30 in. in winter. Where rainfall is much less than this, as in Eastern Bolivia, the yield of tannin is much reduced.

Quebracho Colorado has a hard, heavy, strong, durable wood, weighing from 78 to 87 lb. per cu. ft., which is excellent for general construction, posts, sleepers, and cabinet work. Its chief value, however, is as a source of tannin, the yield being twice that of Hemlock; tannin constitutes about 22 per cent. of the substance of the tree. The species takes 100 years to reach maturity and lives about 150 years.

White Quebracho (*Aspidosperma* sp.) has a high percentage of tannin in its foliage but little in its bark, and is not exploited for its tannin content. The wood is strong and tough and makes excellent wheel spokes and rims. Its widest use is as fuel, and the bark is used medicinally.

Logging operations in the Gran Chaco region are difficult and expensive owing to inaccessibility, heavy rainfall and floods in the rainy season, drought in the dry season, and lack of stone or gravel for road and railway construction. Fortunately trees are distributed near the rivers and the factories are on river banks. After the trees (Quebracho Colorado) are felled, the bark and a layer of sapwood are stripped and twigs and other waste are used as locomotive fuel. The wood is one of the heaviest known and will not float, so it has to be transported on rafts or boats to the mills, most of which are on the Parana River. A single tree weighing a ton yields 600 lb. of extract; the growing of a comparable amount of Oak bark would require an area of about ½ acre of land. At present only the heartwood is used, but as the timber becomes less plentiful, no doubt the sapwood (3 to 4 per cent. tannin) and bark (6 to 8 per cent. tannin) will be used.

Some account is given of the extraction and preparation of tannin from Quebracho and the organization of the industry. As a whole, the industry has an estimated life of 40 years, not taking into account the use of lower grade material. A progressive forest policy might lengthen the life of the industry, but no attempt has been made at reforestation as the rotation of this species (100 years) is too long a period to interest private investment.

32.25. STOVALL, C. **A manual for fallers, buckers, scalers, bull buckers.** *Timberman* 45 (5; 6; 7; 8; 9), 1944–45 (40–2; 42, 44; 50, 52–3; 44, 46, 48; 34, 36, 38). [788].

An illustrated, detailed account of methods of felling a tree, cross-cutting it into logs, marking it and scaling it in the woods. The manual is a first attempt to cover this neglected field of logging literature with the object of increasing production, making work more efficient and less wasteful, reducing accidents by indicating safer methods, and furnishing detailed instructions to the inexperienced.

32.25 : 07.7. **New power-driven saw of novel type.** *Sth. Lumberm.* 169, 1944 (59). [789].

The Lawther C-saw is a portable power-driven circular saw, which can be operated by one man for felling, limbing and cross-cutting. The saw is built for rough use; its frame is of welded steel, the saw mandrel has two sturdy Timken bearings, there are two needle bearings in the wheel-hub, and the wheels are equipped with heavy industrial tyres and hubs. The 30-in. blade is specially designed, with out-size teeth and extra large gullets, to minimize saw filing and blade upkeep. The saw speed is 1,150 r.p.m. Power is supplied by a 4-cycle Briggs and Stratton 6 h.p. air-cooled petrol engine.

32.25 : 07.7. FRASER, T. B. **Testing power chain saws on pulpwood operations.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 773 (B–7–6), [1945]. pp. [3]. [790].

Tests were made on (1) a Beaver saw weighing 30 lb., manufactured by Industrial Engineering Ltd., and distributed by Just Equipment and Supply Ltd., and (2) a bow-type saw weighing 54 lb., manufactured and distributed by Precision Parts Ltd., to determine their value in cutting wood on landings and strip roads; the results were chiefly useful in indicating weaknesses, which have since been corrected by the manufacturers. The greatest disadvantage encountered was the difficulty in starting the mechanical saws in cold weather. Cutting speeds on frozen woods were as follows:—

Log diameter	*Cutting time*
8 in.	11 sec.
10 in.	18 sec.
13 in.	27 sec.

It is considered that small power saws may well replace Swedish bucksaws for cross-cutting pulpwood, though not for felling.

32.29.1 : 07.7. **Splitting gun.** *W. Cst. Lumberm.* 72 (4), 1945 (116). [791].

The Webber splitting gun is used for splitting wood, cracking stumps, blowing holes for tree planting, setting posts, etc. It is filled with powder, fitted with a fuse, and then driven into the end of the log; the fuse is lit and when it fires the log is cracked open into several pieces. The gun is made in two sizes, the heavier one seldom being used on logs of less than 3 ft. in diameter.

32.9. *Transport*

32.91.12. KOROLEFF, A. **Skidding wood by wire.** *Pulp Paper Mag. Can.* 45, 1944 (904–5). [792].

An account of a method of delivering wood, 4-ft. pulpwood in this case, from a steep hillside to the landing place by stringing No. 9 telephone wire from a drum or a tree at the top of a hill to a tree at its base, driving a 2½-in. nail about 1 in. into the bolt of wood, bending the top of the nail and then hooking it on to the wire and shooting the bolt downhill on the wire. At the bottom of the hill, the bolt strikes the tree and drops to the ground. The length of wire averages 300 to 400 ft., but may be as much as 500 ft. One man puts in the nails and another hangs the wood on the wire. In the example given, 2 men skidded twice as much wood as would be handled by a man and a horse in the same time, and moreover the hillside was too steep and dangerous for a horse. The practice had to be discontinued because of the risk of getting nails into pulpwood grinders. Suggestions are made for further experiments on this method.

32.91.12 (73) : 07.7. FLYNN, T. P. **U.S.F.S. Tomcat log tractor.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 767 (B–8–f). 1945. pp. [4]. [U.S. Forest Service, North Pacific Region, Portland, Ore.] [793].

Description and specification of a tractor for skidding logs on the West Coast, designed and built in 1944 by the U.S. Forest Service, Portland, Oregon. A principal object in the design was to provide ample track area properly proportioned to give flotation for operation on muddy ground. This tractor has 9,000 sq. in. of track on the ground compared with 5,000 sq. in. in a Cat D8, and its track pressure is only one-half that of the latter. In field tests it proved able to haul log loads 50 per cent. larger than those hauled by conventional crawler tractors, did less damage to reproduction and young trees, continued to work in conditions where other types bogged down, and improved the road for other tractors.

32.92–4 (485) : 33.06. Vedflottning prövad i Jämtland. [**Wood floating tested in Jämtland.**] *Skogen* 32, 1945 (91). [Sw.] [794].

Tests in floating firewood logs have proved so successful in Jämtland during the last two summers that the Emergency Period Committee has decided to recommend the extended adoption of the method. The wood should be removed from the water as soon as possible; if left for more than two weeks the logs begin to sink—particularly Aspen and similar woods.

Floating must be concluded by September 1st, as after that the weather becomes too cold for the work to be carried on. R. P. J.

32.93. STOVALL, C. **Raising a spar tree.** *Timberman* 46 (8), 1944–45 (100). [795].

Illustrated directions for raising a spar tree in cases where there is no suitable standing tree near enough to the required spot.

32.96 : 33.02 : 07.7. **New method increases wood recovery.** *W. Cst. Lumberm.* 72 (5), 1945 (62–3). [796].

A brief description is given of a new machine designed for bundling pulpwood, by means of which large quantities of wood can be moved economically and efficiently in units of ¼–1 cord. The machine is operated either by steam or compressed air, and can be loaded by hand or by conveyor. After loading, the wood is pulled tightly together and a ¾-in. steel band is placed round the bundle and fastened with a patent fastener. The bundles can be towed in a boom or loaded on a truck or railway wagon.

32.96 : 07.7. STEINHAMAR, S. **Pulpwood loading with crawler-type crane and slings.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 766 (B–10), [Mimeographed], 1945. pp. 5. [797].

The Dryden Paper Co. Ltd., Dryden, Ontario, has been using dredging cranes for

loading trucks with pulpwood in the forest since the wartime shortage of manpower. Details are given of the methods of loading and trucking used. The loading crew consists of operator, two slingmen, and top loader on each shift. It is seldom possible on a 20- or 30-mile haul to work a crane loader to full capacity, but as many as 20 trucks have been loaded by one crane, the production over 24 hours reaching 700 cords. The loading expenses are warranted by savings on skidding, on road building and on trucking time, and the assurance that the mill's requirements will be met.

32.96 : 07.7. **Portable Pine log loader.** *Timberman* 46 (9), 1944–45 (78, 80). [798].

An illustrated description of a new mobile Pine log loader designed at the Blacks Mountain Experimental Forest in California. The loader handles logs up to 38 ft. long and up to 3,000 bd. ft. in volume and can make a direct line lift of 12 tons.

33. CONVERSION AND PRESERVATION OF WOOD

33.0. *Utilization Categories of Wood*

33.09 (77.3) : 12.26–8. WALTERS, C. S. **Fiberwood production in Illinois.** *J. For.* 43, 1945 (406–7). [799].

The specifications for fibrewood (used in the manufacture of roofing felt) current in Illinois include all hardwood species, except Osage Orange and Black Locust which are considered too hard. An average cord of wood contains about 35 per cent. Cottonwood (*Populus* sp.), 30 per cent. Elm, 15 per cent. Willow, 10 per cent. Silver Maple (*Acer saccharinum*), 5 per cent. Oak, and 5 per cent. miscellaneous hardwoods. It is considered economically impossible for trees of sawlog size and quality to be split into fibrewood; only the tops are utilized. Details are given of prices and costs of cutting, hauling and transporting.

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

33.12. Joinery, Turnery

33.12 : 07.7. HAYCOCK, A. H. **Principles of machine woodworking: tenoning.** *Wood* 10, 1945 (122–5). [800].

It is claimed that a well cut machined tenon is more accurate than, and superior in many ways to, a hand-made tenon. The shearing action of the cutters and the fibre-severing function of the shoulder cutters is explained. Illustrated instructions are given for designing, shaping and grinding both types.

33.12 : 07.7. HAYCOCK, A. H. **Principles of machine woodworking: setting up the tenoner.** *Wood* 10, 1945 (149–51). [801].

Directions are given for setting up the shoulder cutters and tenoning cutters, with practical advice on grinding and sharpening, corrections for backlash or factor of lost motion in the screws and adjusting nuts, and the addition of a calibrated scale to the bosses of the adjusting hand wheels.

33.12 : 07.7. HAYCOCK, A. H. **Aids to efficient tenoning.** *Wood* 10, 1945 (198–201). [802].

The writer recommends certain methods of wood working which he has used and found to give good results, and suggests some improvements in the usual design of tenoning machines.

33.12. **The art of making scythe handles.** *Wood* 10, 1945 (107–9). [803].

Photographs showing the primitive equipment used in bending and shaving poles for scythe handles in a Hampshire village.

33.15. Manufacture of Veneers, Laminated, and 'Improved' Wood. Gluing

33.15. KING, E. P., and WOOD DEVELOPMENT LTD. **Plywood.** *Brit. Patent* No. 558,636, Jan. 13, 1944. Chem. Abstr. 39, 1945 (4268). P.R. [804].

A plywood of low specific gravity useful in aircraft construction has its veneer layers made from a light wood and its interlayers made from fabric or paper impregnated or coated with a phenol-CH_2O resin or the like.

33.15 (73) : 98.1. SLIFKO, C. W. **Veneer and plywood in greater demand.** *Sth. Lumberm.* 170 (2140), 1945 (59–60). [U.S. Department of Commerce.] [805].

Statistics are given for American plywood production in 1943–44.

Total production of softwood plywood, in thousands of sq. ft., $\frac{3}{8}$-in. equivalent, was

1,495,168 in 1943, and 1,484,889 in 1944. Total production of hardwood veneer in thousands of sq. ft. full measure was 9,870,597 in 1943 and 9,304,489 in 1944, and of hardwood plywood 135,186 in 1940 and 143,668 in 1944. 33.15 (73 : 82) : 33.8 : 12.25–8. La elaboración de madera terciada y multilaminar. [**The manufacture of plywood and multi-laminated wood.**] *Maderil* 17 (197), 1944–45 (11–5). [Span.span.] [806].

The article describes the methods of manufacture of plywood and laminated wood in the United States and suggests that the Argentine Republic is well supplied with native timbers eminently suited to take the place of Douglas Fir in the manufacture of laminated and plywoods, since they have trunks of large dimensions and very even texture. Suitable species are Argentine Cedar (*?Cedrela brasiliensis*), Guatambú (*Aspidosperma tomentosum*), Peteriby (*Cordia aliodora*), Guindo (*Nothofagus* sp.), and *Araucaria brasiliana*.

33.15 (81). La industria de la madera terciada en el Brasil. [**The laminated wood industry in Brazil.**] *Mundo maderero* 6 (62), 1945 (17). [Span.] [807].

In the south of Brazil there are 168 factories for producing laminated and compressed wood, of which 102 are in production, and 66 in the course of erection. Of those already working, 7 are situated in São Paulo, 44 in Paraná, 29 in Santa Catarina and 22 in Río Grande do Sul. Those in the course of erection are located at Paraná (36), Santa Catarina (10), and Río Grande do Sul (20). Data are given on the expected monthly production of these factories.

33.15 : 33.8. Lektorski, D. N. Obuvnaya fanera. [**Plywood for shoes.**] *Lesnaya Prom.* No. 1–2, 1944 (16–8). [Russ.russ.] [808].

For soles and welts of shoes, plywood must be flexible enough for shaping during manufacture and thereafter in use. Transverse flexibility depends largely on the thickness of the middle layer. Tests have shown that 3-ply wood with a middle layer 0·4 mm. thick gives the best service. One cubic metre of plywood will supply material for 6,000 pairs of shoes.

33.15 : 38.2. Arend, A. G. **Plywood for modern building.** *Ill. Carp. Build.* 134, 1945 (628). P.R. [809].

Improved panel-production methods are obtained by means of the high-frequency dielectric heating system, which is briefly described. Its advantages over earlier systems of heating the press are less waving and warping, absence of shearing stress on glue lines, greater uniformity of bond, economy in glue and redrying, simplicity in operation, etc. It is claimed that over 10,000 sq. ft. of panels can be dealt with per hour and maximum production has amounted to 13,000 sq. ft. per hour.

Improved methods of bonding make possible any thickness of sheet from $\frac{3}{8}$-in. to 5-in. without impairing quality. Girders of plywood are simple to fabricate and erect, and various economies unknown to ordinary timber constructions are possible.

33.15 : 31.27. Sanborn, W. A. **Effect of thickness of plywood reinforcing plates on the behaviour of solid wood aircraft spars under changes in moisture content.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1527, 1945. pp. 8 + plates. P.R. [810].

Test specimens of quarter-sawn Sitka Spruce spars reinforced with Yellow Birch plywood plates did not split when exposed to atmospheric conditions as extreme as those likely to be encountered by aircraft in service. The splitting of spars of similar size and construction in aircraft is, therefore, apparently due to other factors. Since splitting of the solid spars in the test specimens was not accomplished, a comparison could not be made of the effectiveness of square or pointed ends on plywood reinforcing plates in preventing such splits from extending beyond the plates. When abrupt reductions in humidity conditions caused the moisture content of spars with plywood plates to be unequally distributed, spars with 0·225-in. plywood plates (totalling three-fifths of the spar thickness) showed a tendency to fail at the glue lines between the plates and spars. Although these failures were slight they might be expected to become progressive with fluctuations in moisture content. *From author's summary.*

33.15 : 34.6. Bender, F., and Wakefield, W. E. **Core for laminated material.** *Canad. Patent* No. 424,885, Jan. 9, 1945. Chem. Abstr. 39 (1327). P.R. [811].

Alkali-treated castor pomace is mixed with sawdust or other fillers and a preservative, dried to desired moisture content, and pressed to form a core for laminated material.

33.15 : 38.1. **Standards under development for glued laminated lumber.** *Sth. Lumberm.* 169 (212, 7), 1944 (38–9). [812].

The Central Committee on Lumber Standards at Washington, D.C., has undertaken to establish the necessary machinery for, and to supervise the development of, basic standards for glued laminated lumber products. Eight committees are planned to deal respectively with structural uses, maritime uses, vehicular uses, coverings and panels, millwork, furniture, aircraft, re-manufactured uses. Each committee will be divided into sub-committees to deal respectively with lumber, fabrication, glues, and inspection.

33.15 : 33.34. YOUNG, S. H. A., and PALESE, R. A. M. **Molded wood.** *Mod. Plastics* 22, 1945 (100–4, 196). P.R. [813].

A general description of the preparation, impregnation, drying, moulding, mould designs and existent and potential applications of moulded wood. While indiscriminate application is deprecated, use of moulded wood is indicated where strength, durability and beauty of wood are important. A table of the phenolic-water solution absorption of Ponderosa Pine, Poplar, Maple and Birch is given. Judiciously treated with dyes, they can offer beauty comparable to that of many of the finest hardwoods.

33.15 : 33.32. STAMM, A. J. **Possible uses of improved woods and wood-base plastics in the furniture industry.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1482, 1944. pp. 4. P.R. [814].

Brief descriptions are given of the characteristics and potential uses of Impreg, Compreg, Staypak, Hydroxylin and paper-base plastics. Owing to war conditions only Hydroxylin is, at the moment, available for commercial use. Staypak [cf. *For. Abstr.* 7 (75)] is not yet being manufactured, but possible future uses are outlined.

33.15 : 33.8 : 31.27. Progreses de la fabricación de maderas compensadas para la construcción de aviones. [**Advances in the manufacture of improved woods for aeroplane construction.**] *Maderil* 17 (199), 1944–45 (15–6). [Span.] [815].

A short general account of the development in the use of plywood and laminated woods in aeroplane construction, with particular reference to types of glue. Tables are given showing strength properties of three-ply and laminated wood.

33.15. DELMONTE, J. **Wood-cloth and wood-paper laminates.** *Trans. Amer. Soc. mech. Engrs.* 66, 1944 (55–9). [Plastic Industries Technical Institute.] O.R.S. [816].

The article gives details of tests carried out at the Plastics Industries Technical Institute on combinations of résin-impregnated cloth and paper with wood. It is apparent that there are physical advantages in combinations of this kind. There is some evidence that when a reasonably large number of paper laminates are present there is an apparent increase in the tensile properties of the wood attributable to pre-stressing of the wood brought on by differences in coefficients of thermal contraction as parts are cooled upon removal from the press. Plywood faced with phenolic-resin-treated cloth and paper is far superior to unprotected plywood in dimensional stability.

33.15. CONSIDINE, R. J. **See promise in papreg for aircraft structures.** *Aviation* 44 (4), 1945 (142–4, 255, 257, 259, 261). L.S. [817].

The Douglas Aircraft Co. presents comprehensive test data in graphs and tables which define the basic strength characteristics of impregnated paper-base laminates alone and in combination with plywood for primary structural application. The high-strength laminate used was made according to specification CPS–MP11; the cores used in combination were ¼-in. Birch and Spruce. The tests show that papreg with an ultimate tensile strength of 31,300 lb./sq. in. and a specific gravity of 1·36 compares favourably with 24 STAL on a strength/weight basis, and shows promise of answering a need in structural design. When papreg is bonded to the outer faces of a wooden core the strength properties of wood are greatly increased and wood structures can be designed to carry loads far in excess of the normal wood strength. Nevertheless, papreg does suffer from low elongation and consequent low resistance to stress concentration. Assembly methods such as bolting or riveting would need a reduction in the allowable strength of the material.

33.15. MEYER, H. R., and ERICKSON, E. C. O. **Factors affecting the strength of papreg. Some strength properties at elevated and subnormal temperatures.** *Mimeo. U.S.*

For. Prod. Lab., Madison No. 1521, 1945. pp. 7 + tbls. + figs. P.R. **Factors affecting the strength of papreg. Effect of accelerated weathering on certain strength properties of papreg.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1521A, 1945, pp. 7 + tbl. + figs. P.R. **Factors affecting the strength of papreg. Effect of moisture on certain strength properties of papreg.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1521B, 1945. pp. 12 + tbls. + figs. P.R. **Factors affecting the strength of papreg. Effect of repeated cycles of freezing and thawing on certain strength properties of papreg.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1521C, 1945, pp. 6 + figs. P.R. [818].

The material (papreg) used in these tests consisted of a paper made from a commercial unbleached Black Spruce, Mitscherlich type, sulphite pulp, the paper being impregnated with a Bakelite, phenolic type, thermosetting resin and moulded to form parallel-laminated and cross-laminated panels, approximately 12 in. square, and $\frac{1}{16}$, $\frac{1}{8}$ and $\frac{1}{2}$ in. in thickness.

The conditions and results of the tests described in these illustrated reports are briefly as follows in order of titles given above.

(1) Tension, compression, bending and impact strength tests were made on papreg at temperatures of 69°, 75°, 158° and 200° F. In general, these tests indicate that the tensile, edgewise compression, and static bending properties are adversely affected at elevated temperatures but tend to improve at subnormal temperatures.

(2) Tests were made to determine the influence of accelerated weathering on the tensile, compressive, flexural, bearing, and hardness properties of papreg, which was exposed continuously for 240 hours by repetition of the following 24-hour schedule: (1) 2 hours in a fog chamber, (2) 2 hours' irradiation, (3) 2 hours in a fog chamber, and (4) 18 hours' irradiation. In general, strength properties were improved slightly by this treatment.

(3) Tests were made at normal temperatures to determine the effect of moisture on certain tensile, compressive, flexural, and bearing properties of $\frac{1}{8}$-in. papreg. In general, a decrease in strength properties accompanied an increase in moisture.

(4) The results of approximately 800 strength tests on papreg showed that repeated cycles of freezing and thawing had a negligible effect on the tensile, compressive, bending, and bearing properties of this material.

33.15 : 33.32 : 31.2. AMIOT, L.-P. Le bois et les résines synthétiques. [**Wood and synthetic resins.**] *For. québec.* 10 (1), 1945 (69–83). [F.] [819].

This article gives a general account of the use of synthetic resin for the manufacture of improved woods, plywood and plastics, with a short description of the method of manufacture of each of these products, the resins employed, and the properties which they communicate to the treated woods.

33.15. KAUFERT, F. H. **Preliminary experiments to improve the gluing characteristics of refractory plywood surfaces by sanding.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1351, 1943. pp. 4 + figs. + tbls. P.R. [820].

Light hand-sanding of plywood surfaces is very beneficial in correcting surface conditions which interfere with the adhesion of cold-setting glues in aircraft-assembly operations. Reductions in face-ply thickness should never exceed 10 per cent. and, whenever possible, should be limited to ·001 in., or significant strength decreases will occur. Frequent thickness measurements are advisable. In order to be of maximum value, light sanding should follow masking and sealing operations. The results of tests on Yellow Birch, Sweetgum, Mahogany and Douglas Fir are given.

33:15 : 31.27. THUNELL, B. Förfarande vid hållfasthetsprovning av lim för sammanfogning av trä och klassindelning med hänsyn till motståndsförmågan mot fukt och vatten. [**Procedure in testing strength of glue for cementing wood, and classification of glue with respect to power of resistance to damp and water.**] *Circ. svenska Träforsk-Inst.* No. 1, 1944. pp. 4. [Sw.] *Repr.* from *Trävaruindustrien* No. 20, 1944. P.R. [821].

The most important commercial varieties of glue can, as regards origin, manufacture, etc., be divided into the following main groups: animal glue, animal glue with a hardening medium, casein glue, blood-albumin glue, vegetable protein matter (together with casein), starch glue, carbamide-resin glue and phenol-resin glue. Factors that are of decisive importance in testing the strength qualities of these glues are noted, and instructions are given for the preparation of each type of glue.

The timber used in the tests was sapwood of

Pinus sylvestris and *Fagus sylvatica* of Swedish origin. Directions are given for application, pressing, cleaning and conditioning of the samples, the carrying out of the actual testing, calculation of results, and classification of the different kinds of glue in respect to resistance to moisture. R. P. J.

33.15. ZABRODKIN, A. G. Rastitel'nȳe kleematerialȳ v fanernoy i spichechnoy promȳshlennosti. **[Vegetable glues in the plywood and match industries.]** *Lesnaya Prom.* No. 6, 1944 (16–20). [Russ.] [822].

Insufficient supplies (caused by the war) of animal glues for use in plywood and match industries, compelled Russian scientists to examine possible substitutes in vegetable glue materials. Two groups of albuminous glues were investigated: (1) from legumes (soya beans, vetch, 'Vika' and lupin), and (2) from oil seeds (sunflower, hemp, castor-oil and cotton). The methods of extracting albumen from the above-mentioned beans and seeds, and of preparing the glue, are briefly outlined.

33.15 : 31.27. YOLTON, L. A., and SANBORN, W. A. **Effects of variations in design on the strength of some typical glued fastenings in wood aircraft.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1526, 1945. pp. 20 + plates. P.R. [823].

Tests were made to determine the general principles governing the strengths of such fastenings. Cold-setting urea-formaldehyde glue, which developed sufficient shearing strength to cause wood failures in practically all the joints tested, was used. Sitka Spruce glued to saddle gussets of Yellow Poplar and Mahogany plywood of three sizes, 0·070-, 0·100- and 0·125-in. thickness, were tested for bearing strength. Several types of square and triangular corner blocks between ribs and spars of Sitka Spruce were tested for shearing strength. The results showed that concentrations of stress occurring in the joints of glued fastenings prevented the development of the full strengths over the entire area of the critical joints. The extent to which these strengths were affected varied with the relative size, shape and elastic properties of the joined members.

33.15 : 33.36.1. KAUFERT, F. H. **Increasing the durability of casein glue joints with preservatives.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1332, Oct. 1943. pp. 18 + tbls. + graphs. P.R. [824].

Trichlorophenol and sodium trichlorophenate were the most effective of those preservatives which were extensively tested. Sodium tetrachlorophenate, sodium pentachlorophenate and pentachlorophenol are equally good preservatives; orthophenylphenol is better than sodium orthophenylphenate. Good results were obtained with mixtures of several of these preservatives, but none appeared to be as effective in casein glue as might be concluded from the data available on their toxicity to micro-organisms. None of the compounds tested appeared to affect the life or mixing characteristics of the glues after storage for about seven months. Every preservative tested was found to have some effect on the viscosity of the glues, but this could be controlled by the mixture of several preservatives. The working life of some casein glues was affected to a greater extent than that of others. The rate of setting of casein glues was not greatly affected by the use of preservatives.

There was no discernible difference between the resistance of preserved and unpreserved glues to continuous exposure at a temperature of 158° F. and 60 per cent. relative humidity.

33.15. ROBINSON, J. E. **Adhesive composition.** *U.S. Patent* No. 2,361,418, Oct. 31, 1944. Chem. Abstr. 39 (2230). P.R. [825].

A thermoplastic sealing adhesive for fibre-container joints is composed of polymerized vinyl acetate approximately 60 and Pinewood pitch approximately 40 per cent. To obtain the Pinewood product, extract Pine wood with a coal-tar solvent and drive off the volatile components. Extract the residual material with a petroleum-hydrocarbon solvent, separate the petroleum-solvent constituents and use the residue in the adhesive.

33.16. Wood-wool (Excelsior) Manufacture

33.16 : 12.25. KASWELL, E. R. **Determination of Redwood bark fibre in wool-Redwood fabrics.** *Amer. Dyest. Rep.* 33, 1944 (237–8). P.O. [826].

Bark of Redwood (*Sequoia sempervirens*) has been used for some time as a textile fibre, being blended with wool for the manufacture of various types of materials. In order to determine the per cent. composition of these constituents two methods of quantitative separation are employed: (1) the sulphuric-acid method by which cellulose is dissolved out, the

wool remaining; (2) the potassium-hydroxide method by which wool is dissolved out, the cellulose remaining. Redwood is at least partially soluble in both reagents, and it is shown that greater accuracy is obtained by the second method, which is recommended for future use.

33.16 : 38.1. STRABLE, J. F., and GYPROC PRODUCTS LTD. **Manufacture of wood-wool slabs for building purposes.** *British Patent* No. 566,890, June 1, 1943. Brit. Abstr. BI, 1945 (130). P.R. [827].

A mixture of 200 lb. of Portland cement and 15 lb. of dry CO_2-free $Ca(OH)_2$, of which at least 95 per cent. passes 170-mesh, is heated at 55° to 65° (60°) and then mixed with 100 lb. of wetted (Larch) wood-wool fibres; the product is heat- and pressure-moulded.

33.17. Sawmilling

33.17 : 07.7. HAYCOCK, A. H. **Planer knife technique.** *Wood* 10, 1945 (63–6, 89–92). [828].

Practical directions for the setting of knives in combined surfacing and thicknessing machines and in panel planers, with a discussion of associated problems of cutting angles and grinding angles in connexion with knives and cutters. The best angle for grinding planer knives to give good all-round results with soft-woods and hardwoods is 30°, which enables a set of knives to be re-sharpened 4 to 6 times without taking them from the cutter block for re-grinding. Only for abnormally hard woods is a grinding angle of up to 40° needed for a high standard of work.

The natural cutting angle of a knife produced automatically by the combination of plain-faced knives or cutters and standard cutter-blocks is almost ideal for a wide range of work on soft-woods and some hardwoods, but is less suitable for hardwoods with unfavourable grain. Suggestions are made for preventing the wedging and splitting action of cutters on woods with haphazard grain, e.g. fitting back irons to the cutters, reducing cutting angle, reversing the knives in the cutter-block, reducing the feed speed, etc. Most of the work in an average mill should be satisfactory with (1) knives ground with a back bevel only of 30°, (2) knives ground with a back bevel of 30° plus a face bevel at such an angle that when in operation their cutting angle is only half the natural angle, and (3) knives ground with a back bevel of 30° and used the opposite way round in the cutter block.

33.19. Other Forms of Mechanical Conversion

33.19. STACOM, M. J. [to Stacom Process Corp.] **Disintegration of cellulose materials.** *U.S. Patent* No. 2,374,046, April 17, 1945. Chem. Abstr. 39, (3159). P.R. [829].

Description and drawings are given for a ring and roll disintegrator by means of which wood and other cellulose materials can be disintegrated at high pressure. In this way ground wood and wood flour are obtained.

33.3. *Chemical Treatment*

33.3. ARIES, R. S. **New products of wood.** *Sth. Lumberm.* 170 (2137). 1945 (44, 46, 48). [Northeastern Wood Utilization Council, New Haven, Conn.] [830].

A brief general account of various forms of chemical utilization of wood. Although at present chemical conversion utilizes less than one-tenth of the amount used by mechanical processes, this may easily be doubled in the near future.

33.32. Pulp and Paper Manufacture. Plastics

33.32 (469) : 12.26–8. SEABRA, L. S. V. DE. Sobre o valor de algumas essências folhosas na indústria da celulose. **[On the value of some hardwood species in the cellulose industry.]** *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (448–9). [Port.] E.M.B. [831].

Conifers, particularly those of the genera *Abies*, *Picea* and *Larix*, are the main source of raw material for the Portuguese wood-pulp industry, but this supply is insufficient to meet the extensive demand. Although the pulp produced from hardwoods does not possess qualities identical with those of conifers, it is nevertheless useful in the manufacture of certain types of paper and in the plastics industry. The object of this study is to examine the possibility of utilizing some hardwoods which are known to be adaptable to Portuguese conditions for the production of pulp. The species tested were *Populus alba*, *Betula verrucosa*, *Ailanthus peregrina*, *Acacia melanoxylon*, *Eucalyptus globulus* and *Castanea sativa*. Chemical, microscopic and mechanical analyses of the pulps showed that, apart from a certain difficulty in delignification, and the

deep colour of the *Castanea* pulp, all the species examined showed technical qualities suitable from the point of view of cellulose production. The utilization of *Acacia*, *Betula* and *Eucalyptus* in the cellulose industry appears to be compatible with the economic conditions of their growth and exploitation.

33.32 (71) : 98.2. LITTLE, E. M. **The pulp and paper industry of Canada.** *For. québec.* 9, 1945 (411–6, 419–24, 427–33). [E.] [832].

The history, present state, and future development of the Canadian pulp and paper industry are reviewed. The industry has expanded fifteenfold between 1908 and 1942. Canada's economically accessible forests could, with proper forest management and adequate protection against fire and disease, support an industry 2½ times its present size. Canada's total productive forests could, with radically improved logging methods and the provision of adequate transportation facilities, and proper forest management, support a pulp and paper industry 4 or 5 times its present size. About 60 per cent. of the economically accessible forests and also about 60 per cent. of the total productive forests of Canada, and half the pulp and paper industry, are located in the province of Quebec. The present world demand for pulp and paper products (about 30 million tons) is approximately equal to the present world producing capacity, and further increases in demand will require further expansion in production facilities. The world demand increased about 500,000 tons annually between 1908 and 1920, and by 800,000 annually from 1920 to 1940.

33.32 (71) : 98.1–3. POULIOT, L. J. **Pulp and paper.** *Timber of Canada* 5 (9), 1944–45 (26–30, 60, 62). [Forestry Branch, Dominion Bureau of Statistics.] [833].

A general account of the history of the pulp and paper industries in Canada, with statistics of production, imports, exports and consumption of pulp and pulpwood. In 1908, 66 per cent. of the total Canadian production of wood pulp was exported, but by 1938 exports accounted for only 15·1 per cent. of production. The maximum production of pulpwood was reached in 1942 with 9,653,574 cords.

33.32. MACDONALD, R. G. **Some technical aspects regarding the future of paper products.** *Paper Tr. J.* 120, 1945 (46–8). P.R. [834].

The problems involved and progress made in adapting pre-war paper and paperboard products to wartime uses are outlined. Consideration is given to the raw materials such as groundwood and chemical pulps which will be available to paper manufacturers for post-war markets, and new uses are briefly described.

33.32 : 12.26–8 (73). BRAY, M. W. **Possibilities of hardwood for pulping.** *Sth. Pulp Paper J.* 7 (12), 1945 (12–3, 36). [U.S. Forest Service.] [835].

Data collected by the U.S. Forest Service show the need for increasing the utilization of hardwoods in the production of pulp, from the standpoint of forest management and of pulpwood supply. The results of experiments at the Forest Products Laboratory are briefly described and indications are given of ways in which hardwoods may be used advantageously for pulping. Although most hardwoods are more easily reduced to pulp than softwoods, they may be advantageously cooked together for the production of pulp suitable for liner boards. High-yield processes, such as the neutral sulphite and the sulphate semi-chemicals, are especially adaptable to the hardwoods for the production of pulps suitable for board and many other products, including newsprint, and even, after bleaching, for the finer grades of paper. The species considered are Aspen (*Populus tremuloides*), Cottonwood (*Populus* sp.), Bitter Pecan (*Carya texana*), Sweetgum (*Liquidambar styraciflua*), Black Willow (*Salix scouleriana*), American Elm (*Ulmus americana*), Sugarberry (*Celtis occidentalis*), Green Ash (*Fraxinus pennsylvanica*), Blackjack Oak (*Quercus marilandica*).

33.32. REICHERT, J. S. **Sodium peroxide bleaching of mechanical pulps.** *Paper Ind.* 27, 1945 (116, 118, 120). P.R. [836].

A brief account is given of the process. Spruce, Balsam and Poplar react favourably to this treatment, which results in greatly improved brightness without change in bulking properties or opacity of groundwood. Further advantages and economic factors of the treatment are discussed.

33.32 : 34.6. GELLER, B. **Plastic material.** *U.S. Patent* No. 2,366,781, Jan. 9, 1945. Chem. Abstr., 39 (2229). P.R. [837].

A lignocellulosic material, such as sawdust or shredded wood, is dispersed in an inert hydrocarbon bath, such as molten paraffin, preheated before mixing. While the dispersion is heated and agitated, urea, a mixture of AcOH

and H_2SO_4 and lignin resin such as pure lignin is added to it. Subsequently the agitation is stopped and the resulting plastic is separated from the bath and washed. For moulding, a small amount of AcOH and lignin is added to the purified material. Moulding temperatures are 240° to 330° F., and pressures of 2,000–5,000 lb. per sq. in.

33.32. Forestal Land Timber and Railways Co. Ltd., and Rottsieper, E. H. W. **Manufacture of [resinous] mouldable materials.** *British Patent* No. 567,495, Mar. 1, 1943. Brit. Abstr. BII, 1945 (189). P.R. [838].

A tannin extract of Quebracho wood, etc., is mixed with a fibrous filler, such as asbestos or Pine flour, an aldehyde (preferably solid such as paraformaldehyde) and other resin-forming components such as NH_2Ph, urea, PhOH. Plasticisers are also incorporated. Eight examples are given.

33.32. British Celanese Ltd. **Cellulose acetate-formate production.** *British Patent* No. 568,439, April 5, 1945. Brit. Cotton Ind. Res. Ass. Summ. 25, 1945 (256). P.R. [839].

Cellulose acetate-formate is produced by mixing cellulose with formic-acetic anhydride, and then carrying out esterification in the presence of a catalyst, preferably sulphuric acid, at a temperature which is preferably not allowed to exceed 30° C. The esterification should be carried out in the presence of a liquid diluent which may be either a solvent or a non-solvent for the cellulose acetate-formate produced. The cellulose may be pretreated with acetic or formic acid or a mixture of the two in order to render it more reactive. Cotton, cotton linters, wood pulp, regenerated cellulose or cellulose obtained from other sources may be esterified by this method.

33.32. Dreyfus, H. **Cellulose from lignocellulosic material.** *British Patent* No. 557,324, Nov. 16, 1943. Chem. Abstr. 39, 1945 (2648). P.R. [840].

A method of subjecting cellulose substantially free from lignin and hemicelluloses to a delignifying treatment. The delignified materials are heated in a dilute aqueous solution of acid other than nitric and nitrous acids and treated with a mercerising solution of caustic alkali in order to dissolve hemicelluloses. The alkaline solution containing the hemicelluloses is then removed from the materials.

33.34. Dyeing and Bleaching of Wood

33.34 : 12.11.12. Krasulin, N. P. O vnekornevom vvedenii v derevo veshchestv v tselyakh okraski drevesinȳ. [**The introduction into trees, above the root, of substances for colouring the wood.**] *Trud.vsesoyuz.nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 21, 1941 (145–59). [Russ.russ.] [841].

The introduction into living trees of solutions designed to stain the wood is difficult, as the irregular distribution of the water-conducting elements within the annual rings results in a selective coloration of the wood according to its structure. Filtration of dye solutions through the cut ends of a log appears to be a more practicable method and could be employed with freshly cut logs and logs stored in water.

As the dye solutions pass chiefly through the peripheral annual rings, the wood thus stained might be most suitably employed in veneer form.

33.34. MacBean, N. A. **Bleaching of wood.** *U.S. Patent* No. 2,312,218, Feb. 23, 1943. Brit. Abstr. I, 1945 (103). P.R. [842].

The wood is steeped in a saturated aqueous solution of Na_2O_2 and, after being allowed to dry, is evenly treated with H_2O_2 to neutralise the Na_2O_2. All operations are effected at room temperatures.

33.36. Preservation of Wood. Seasoning and Drying

33.36.1. *Preservation against Attack by Plants and Animals*

33.36.1 : 33.31 : 31.42.12. Flenner, A. L., Kaufert, F. H., and Salzberg, P. L. (to Canadian Industries Ltd.) **Preservation of wood.** *Canad. Patent* No. 424,485, Dec. 19, 1944. Chem. Abstr. 39 (1036). P.R. [843].

To control the blue-staining fungi and the blue moulds, freshly sawn lumber is treated with an aqueous solution of the reaction product of an inorganic mercurial compound capable of ionizing in acid media with $PbEt_4$ and pentachlorophenol. For example, a mixture of HgO 660, $PbEt_4$ 530, and talc 2,300 parts is added to sufficient EtOH to form a paste and 360 parts of 85 per cent. H_3PO_4 added; the reaction mixture is dried, and a mixture of product 33 and Na pentachlorophenolate 20 parts mixed with 47 parts of borax. This mixture dissolved in water prevents stain fungi and blue moulds in Oak and Chestnut lumber.

33.36.1 : 76.1. ARIES, R. S. **Economy of wood preservative treatments.** *Timber of Canada* 5 (9), 1945 (35–6). [Northeastern Wood Utilization Council, New Haven, Conn.] [844].

A table is given of annual charges on cost of timbers in place, from which, if the average life of treated and untreated timbers and the cost of each in place are known, it is easy to compute the relative annual costs of maintaining the two. The table can also be used to find the percentage of the cost of the untreated material that can be expended for treatment without increasing the annual charges for the untreated wood. The formula used for this purpose is

$$P_1 = \frac{100\,(Au - At)}{(At)}$$

where P_1 = percentage of cost of untreated timber than can be used for treatment, Au = annual charge for untreated material, At = annual charge for treated material.

33.36.1 : 12.26–8 : 13.2 : 31.43. WOLCOTT, G. N. **How to make wood unpalatable to the West Indian dry-wood termite, *Cryptotermes brevis* Walker. III.** *Carib. For.* 6, 1944–45 (245–66). [E.Span.f.] [845].

This article gives a further account of studies on the efficacy of various chemical compounds for preventing attack by the drywood termite (*Cryptotermes brevis* Walker) [cf. *For. Abstr.* 5 (189), 6 (178)]. Pentachlorophenol is one of the most satisfactory and at the same time commercially available compounds; treatment in a 1-per-cent. solution of this chemical will protect wood for nearly a year, and treatment with a 5-per-cent. solution should give more than 5 years' protection. Treatment with 2-per-cent. DDT appears to be promising. Copper pentachlorophenate is effective but is not commercially available. Zinc fluoride costs about 5 times as much as zinc chloride but is 20 times as effective against drywood termites.

Tables show: (1) the number of days wood samples need to be exposed to air, following 10-minute dips in the various chemicals, before termites attack them; (2) the relative value of the various elements tested in comparison with the natural resistance of *Swietenia mahagoni*.

33.36.1 (73) : 33.31 : 33.52 : 33.53 : 33.36.2. HELPHENSTINE, R. K. **Quantity of wood treated and preservatives used in the United States in 1943.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (402–26 + tbls.). [846].

Data are given on the distribution, class and type of treating plants in the United States, the consumption of preservatives, the range of prices paid for preservatives (1942–3), the quantities of domestic and imported creosote used (1909–43), and the preservatives used and materials treated during 1943.

33.36.1. **Report of Committee 5–9—inspection.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (144–53). [847].

Tentative Standard Instructions for the inspection of preservative treatment of wood (33*c*) were adopted and are given in full in the report.

33.36.1 : 33.31. **Report of Committee 4—preservatives.** With discussion. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (25–47). [848].

Revisions of Standard Specification for creosote coal-tar solutions (5*e*) are adopted as a temporary measure to meet emergency conditions. The following specifications are adopted as tentative standards of the Association:—(1*c*) Methods of analysis for salt preservatives; (20*b*) methods for determining penetration of salt preservatives; (60*a*), (61*a*), (62*a*) specifications for chromated zinc chloride, tanalith, zinc meta-arsenite. These methods and specifications are given in full in the report. [Cf. *For. Abstr.* 6 (35).]

33.36.1 : 33.52 : 12.25–8. **Report of Committee 7–1—tie service records.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (162–171). [849].

Records are given for a test track of sleepers, representing a variety of species, preservative methods and service periods.

33.36.1 : 33.53. **Report of Committee 7–7—pole service records.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (213–22 + tbl.). [850].

Details are given on the service records of pole installations, representing various species and preservative treatments.

33.36.1 : 33.53. **Report of Committee 7–4–1—marine pile service records.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (194–213). [851].

Service records are given of creosoted piles in Seattle harbour. An account is given of creosoted piles at Oakland port; the piles, which had been in service for about 30 years, were mostly in excellent condition. A report is given of 1943 inspection of piling in San Francisco Bay, some of it dating back to 1898. Notes are given on the care necessary in installing and handling mineralized-cell-treated piles.

33.36.1 : 38.3. **Report of Committee 7–2—bridge and structural timber.** With appendix. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (172–86). [852].

Service records are given of 9 railway bridges on which complete data of construction and preservative treatment are available.

33.36.1 (73) : 33.4 : 38.2–5. KETCHUM, V. **Post-war timber work adapted to preservative treatments.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (109–15). [853].

A general account of the probable post-war needs for treated timber in the U.S.A. for use by railways, in highway construction, for farm buildings, etc.

33.36.1 : 33.53 : 12.25. **Report of Committee 5–5–2—Poles, non-pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (138–43). [854].

Additional information is given on two methods of ground-line preservation. [Cf. *For. Abstr.* 4 (179), 6 (36).]

33.36.1 : 33.4 : 33.52 : 12.26–8. **Report of Committee 5–1—Oak ties and lumber, pressure treatment.** With discussion. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (68–76). [855].

A new method has been devised for measuring the penetration of preservatives into Red Oak, based on percentage of rings penetrated. A tentative standard specification (52*a*) for the preservative treatment of Oak ties and lumber by pressure processes was adopted and is given in full in the report.

33.36.1 : 33.52 : 12.25. **Report of Committee 5–2—Southern Pine ties and lumber, pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (116–7). [856].

Some revision has been made of (53*b*) Tentative Standard Specification for preservative treatment of Southern Pine ties and lumber by pressure treatment (to replace Standards 34*b* and 35*c*), and its continuance for another year was approved. [Cf. *For. Abstr.* 6 (35).]

33.36.1 : 33.53 : 12.25. **Report of Committee 5–5–1—Poles, pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (122–6). [857].

Some changes were put forward and approved in the Tentative Standard Specification for the preservative treatment of Western Red Cedar (*Thuja plicata*) poles. [Cf. *For. Abstr.* 6 (36).]

33.36.1 : 33.53 : 12.25. **Report of Committee 5–4—Southern Pine piles, pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (120–2). [858].

Certain revisions were adopted for (39*b*) Tentative Standard Specification for the preservative treatment of Southern Pine piles by pressure processes, and the Specification, with these revisions, was advanced to Standard.

33.36.1 : 38.4 : 33.31 : 33.36.2. CHURCH, H. M. **Recent treatment practices of the Chesapeake and Ohio.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (154–161 + dgms.). [859].

Creosote has been used for protection against decay and insect attack wherever painting, surface cleanliness, odour, and fire hazard are not important considerations. Where they are of importance, salt-treated lumber has been used. Specifications are given for fire-resistant treatment of Southern Yellow Pine and Douglas Fir lumber.

33.36.1 : 33.52 : 12.26–8 : 33.31 : 31.42.11. SCHMITZ, H., SCHRENK, H. VON, and KAMMERER, A. L. **Studies of the biological environment in treated wood in relation to service life. II. Decay resistance of Red Oak crossties treated with coal-tar creosote after thirty-four years' service, and its meaning.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (76–107). [860].

A study of the decay resistance of 8 sleepers treated with coal-tar creosote and removed from the track only because of mechanical destruction after 34 years' service shows that test blocks cut from these sleepers decayed under laboratory conditions, though there was no evidence that they were suceptible to the action of wood-destroying fungi under service conditions. This indicates that the conditions under which the laboratory tests are made are more favourable to the growth and development of wood-destroying fungi than are track conditions, and that in the sleeper as a whole the decay resistance of the wood in any zone is influenced by the preservative conditions in adjacent zones. A treated sleeper must be regarded as an ecological unit when considered as a potential habitat for wood-destroying fungi, and it is not possible to reconstruct the decay-resistance of a treated sleeper by piecing together the decay resistance of any parts thereof, no matter how large.

33.36.1 (73 : 71 : 72) : 98. **Wood-preserving plants in United States, Canada, and**

Mexico. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (428–37). [861].

A list of addresses with dimensions of cylinders or tanks in each plant.

33.36.1 : 33.31 : 31.42.1. HATFIELD, I. **Information on pentachlorophenol as a wood preserving chemical.** With discussion. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (47–67). [Monsanto Chemical Company, Saint Louis, Mo.] [852].

A review of the information available on pentachlorophenol as a wood preservative including some hitherto unpublished results from laboratory studies. Technical pentachlorophenol is suitable as a wood preservative and the extra expense involved in recrystallizing it is not justified on the basis of fungicidal efficiency. The solubility of the chemical in a number of common organic substances, its vapour pressure, and analytical data on sleepers treated with it, are given in a series of tables. Pentachlorophenol is not a cumulative poison but precautions should be taken in its use until further toxicological data are available. Twenty-six literature references are cited.

33.36.1 : 33.31 : 31.43 (68). KROGH, P. M. D., and TOOKE, F. G. C. **The toxicity and penetrative capacity of certain pentachlorophenol wood preservative solutions.** *J. S. Afr. For. Ass.* No. 12, 1944 (52–9). [Forest Products Institute, Pretoria West.] [863].

Recent discovery in South Africa of *Hylotrupes bajulus*, *Anobium punctatum* and *Lyctus brunneus* made the development of an inexpensive non-staining preservative imperative. A pentachlorophenol-based mixture was devised in which toxin, solvents and penetrants, in mutual equilibrium, ensure by momentary immersion clean, dry, safe, economical and certain protection against wood borers. The formula is pentachlorophenol 3·85 per cent., linseed oil 21·15 per cent., mineral turpentine 75 per cent. The cost of a one-minute dip to retain 0·13 lb. of dry salt per cu. ft. is 1*s.* 6*d.* per cube, or 1*s.* 1½*d.* and 1*s.* 4*d.* if seal oil or castor oil respectively are used instead of linseed oil.

33.36.1 : 33.52 : 12.26–8. **Preservation of Karri sleepers: long-term observations in Western Australia.** *Mon. News Lett. Div. For. Prod. Aust.* No. 137, 1945 (4–6). [864].

Karri (*Eucalyptus diversicolor*) is a Western Australian timber, relatively non-durable where decay or termite hazard exists. Like other Eucalypt timber, Karri is very refractory to pressure treatment with preservatives but may be penetrated slowly by diffusion of water-soluble chemicals into green timber. The method chiefly used in Western Australia and known as 'fluorizing' consists of boiling the sleepers for 10 hours in a solution of 1–2 per cent. arsenious oxide and 6–8 per cent. sodium fluoride and sodium dinitrophenate in water. Tests were begun in 1929 on about 3,000 fluorized Karri sleepers together with untreated and Jarrah (*E. marginata*) controls in 4 representative localities in the Western Australian Government Railways. A final inspection was made in 1944. The average life of all fluorized Karri sleepers in the test is estimated at 13 years, ranging from 10 to 18 years in the 22 test lengths. Untreated control Karri sleepers gave an average service life of only 6½ years.

33.36.1 : 31.22. BROWNE, F. L., and SCHWEBS, A. C. **A study of methods of measuring the water repellency of water repellents and water-repellent preservatives for wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1453, Oct. 1944. pp. 38 + tbls. P.R. [865].

A study was made of methods of measuring the effectiveness of water repellents for wood with a view to finding one more nearly reproducible than the present N.D.M.A. method (Appendix I). The evidence shows that variability of replicates arises primarily from unrelated differences in the response of individual sapwood boards to the action of a water repellent. In general, the better repellents proved more effective by the small-specimen methods than by the large-specimen method, but the effect may not be proportional for all repellents. The tests carried out are described in detail and the results tabulated. It is recommended that the N.D.M.A. method should remain the preferred procedure modified by a shorter period of immersion. The Western Pine Association swellograph method should be used for routine testing (Appendix IV).

33.36.1 : 33.4 : 33.8. **Report of Committee 7–10—diversified uses of treated wood.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (247–57). [866].

The Association adopted as Standard a revised form of A.W.P.A. Tentative Standard 50*c*, Recommended practice for the use of

pressure-treated lumber in protecting buildings against decay and termites. A report was made on new uses of treated wood, which include oil-well pumping units and Kellner jetties for protecting stream banks from erosion.

33.36.1 : 33.12. **Report of Committee 7–11—uses of treated wood for car lumber.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (258–60). [867].

Some account is given of the use of treated timber in the manufacture of railway rolling-stock.

33.36.1 : 33.31 : 33.36.3. VERRALL, A. F. **The control of fungi in lumber during air-seasoning.** *Bot. Rev.* 11, 1945 (398–415). [U.S. Bureau of Plant Industry.] [868].

The control of mould, stain, and decay fungi in saw timber during air seasoning has become progressively more important with increased utilization of the more fungus-susceptible sapwood. Control is best effected by the use of chemical dips in conjunction with practices which prevent deep-seated log infections, permit quick chemical treatment after sawing, and promote rapid drying in the seasoning yard.

Some of the chemicals used on green sawtimber have been found satisfactory on all species of wood and in all regions [of the U.S.]; others are satisfactory only on certain woods, particularly in certain regions. Some are not effective against moulds, though highly effective against stain and decay fungi. Because green sawtimber is attacked by large numbers of fungi with varying tolerances towards certain chemicals, single-chemical treatments are usually applied at relatively high concentrations to afford an adequate margin of safety. The most recent tests show that mixtures of chemicals promise improved control by reducing the total toxic concentration needed, thus reducing cost and danger of injury to workmen and giving protection against a wider range of fungi. More work is needed on the most advantageous mixtures, the effect on the solution of selective absorption by the wood, and the effect of leaching on mixtures containing borax.

One of the factors affecting the effectiveness of chemicals on green sawtimber is the presence of deep-seated infections in logs before sawing. Much of this infection could be prevented by the co-ordination of logging and milling operations to prevent long storage of logs. When this is not practicable, there is need of more effective chemicals for use on logs. Effective and cheap fungicides are available, but they do not repel bark and ambrosia beetles, which penetrate the logs and inoculate the wood inside the protective chemical shell. The development of effective and cheap beetle repellents is needed.

The reason why certain chemicals (such as borax) are effective only on hardwoods, and others (such as sodium tetrachlorphenate) only on hardwoods in one region, but on both hardwoods and conifers in another region, is not known. It may be a matter of differences in fungus floras, or of chemical or physico-chemical reactions between the fungicide and the different woods. More information is needed on fungus floras on different woods in different regions, particularly those associated with failure of chemicals. *From author's summary.*

33.36.1 : 44.3 : 12.21. HORSFALL, J. G. **Quantitative bioassay of fungicides in the laboratory.** *Bot. Rev.* 11 1945 (357–97). [Connecticut Agricultural Exp. Sta.] [869].

33.36.2. *Fireproofing*

33.36.2. **Report of Committee 9—fireproofing.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (261–347 + tbls.). [870].

A preliminary report is given on the effectiveness of various fire-retarding chemicals, including diammonium phosphate, sodium tetraborate, boric acid combinations, chromated zinc chloride, zinc chloride.

Reports are given on a number of laboratory and fire performance tests.

33.36.2 : 31.45. STEINER, A. J. **Fireproofed wood.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (355–65). [871].

This paper discusses the question of fire tests for use in classifying building materials and structures, and gives an account of a method developed by the Underwriters' Laboratories for the fire-hazard classification of building materials; details are given of equipment used, test procedure, and interpretation of results.

33.36.2 : 33.15. HARTMAN, F. A. **Some properties and uses of fire-retardant wood and plywood.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (348–54). [872].

A general account of the problems to be met in the application of fire-retardant treatment to wood and plywood. It is considered prefer-

able to treat veneers before bonding, rather than the finished plywood. Drying is a difficult process, needing much care. It has been found practicable to combine wood-preservative and fire-resistant chemicals; these combinations are entirely satisfactory, and in some cases excel in wood-preserving value salts at present used exclusively for wood preservation.

33.36.2 : 33.8. SMITH. W. H. **Fireproofed wood for airship hangars.** With discussion. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (17–25). [873].

An account is given of the specifications and tests used in connexion with the fireproofing of timber required in the construction of airship hangars in the United States during the war. Between 3 and 3½ million bd. ft. of timber were used in each hangar, and all of it had to be fire-proofed. Shrinkage troubles on these treated structures were found to be rather less than in structures not given a fire-retardant treatment, and structural properties of treated timber appeared to be at least as good as those of untreated timber.

33.36.3. *Seasoning. Drying*

33.36.3. VOORHIES, G., and LOUGHBOROUGH, W. K. **Suggestions and instructions for kiln operators drying aircraft lumber.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1362, Oct. 1943. pp. 19 + tbls. + figs. P.R. [874].

Methods for testing the operational characteristics of a kiln, suggestions of possible remedies for faulty performance, and explanation of the steps which must be taken to dry aircraft lumber in accordance with current Army-Navy specifications. The instructions covers all details of kiln operation, storage, handling and stacking of lumber, selection, preparation and handling of kiln samples and general sampling and testing procedure with remedies for some of the operational troubles. Schedules of suggested relative humidities for temperatures specified in AN–W–2*a* are given for all the important timbers.

33.36.3. **Test for kiln-dried aircraft lumber.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1368, (revised) 1943. pp. 4 + fig. P.R. [875].

Data on the preparation of test sections and samples before drying, details of the tests to be applied during the drying, and the preparation of test samples after drying.

33.36.3 : 07.7. TORGESON, O. W. **Furnace-type lumber dry kiln.** *Mimeo. U.S. For. Prod. Lab., Madison* No. R1474, 1945. pp. 4 + plate. P.R. [876].

Data and specification for a dry kiln which might meet the drying needs of small sawmills where no steam is available and there is an adequate supply of green sawdust for fuel. An explanatory diagram is appended.

33.37. Distillation. Manufacture of Tar

33.37 : 34.26. LISTER, D. [to Hercules Powder Co.] **Resin distillation.** *U.S. Patent* No. 2,374,220, April 24, 1945. Chem. Abstr. 39 (3169). P.R. [877].

Pinewood resin containing 15–35 per cent. petrol-insoluble resinous material, the intermediate fraction obtained in solvent purification of wood rosin and containing 35–50 per cent. petrol-insoluble resinous material, or the substantially petrol-insoluble fraction containing 85 per cent. or more petrol-insoluble resinous material, is destructively distilled at 300–400°, preferably in an inert atmosphere, with a decarboxylating catalyst such as *p*-toluenesulphonic acid. The distillate consists of noncondensable gases, a resin oil and water. The resin oil is useful in cable insulation, transformer oils, printing inks, lubricants, coatings, etc. The residual pitch has a high phenolic content, and is useful in protection of rope, rubber compounding, the manufacture of oakum, CH_2O resins, brewers' pitch, etc. At the expense of coking the pitch, the yield of resin oil may be increased.

33.37. WHITE, A. H. **Partial pyrolysis of wood.** *U.S. Patent* No. 2,360,604, Oct. 17, 1944. Chem. Abstr. 39 (1292). [878].

Wood is heated externally in a retort at 180° to 275°. When the temperature of the wood reached 150° to 180° an atmosphere containing at least 90 per cent. of steam is passed through the retort. The steam is at a pressure not much higher than atmosphere. The purpose of the steam is to prevent a temperature rise above 275° and to remove the volatile products. The steam leaving the retort is partly condensed and partly re-circulated. This treatment of the wood continues until (1) at least 2 per cent. of acids (calculated as AcOH) on weight of dry wood is produced with no appreciable amount of MeOH, (2) the pentosans are reduced by at least 50 per cent., and

(3) the cellulose is reduced by at least 20 per cent. of the weight of dry wood. At the same time the lignins and at least 50 per cent. of the compressive strength are retained.

33.38. Charcoal Manufacture

33.38.1 (54). DEY, A. C., and VARMA, B. S. **Quality of charcoal produced in indigenous kilns.** *Indian For. Leafl.* (*Chem. and minor For. Prod.*) No. 56, 1944. pp. 4. [879].

A study was made of the quality of charcoal produced from 37 tree species in different types of Indian kilns, data being given on amount of ash, volatiles and fixed carbon, and on density. It is shown that charcoal quality does not depend entirely on the type of kiln but on the temperature at which the wood is carbonized. Care should therefore be taken to carbonize the charge at regulated temperatures.

33.38.1. **Barrel charcoal kiln.** M. and R. Products Inc., Brooklyn, N.Y. pp. 2. P.R. [880].

Details of the filling and firing of a patent open-air kiln by which a 65-gal. barrel will produce 60 to 100 lb. charcoal in 24 hours. Sound hardwood cut in pieces 2 or 3 in. in diameter makes the best charcoal. Even temperature must be maintained by the erection of a windbreak where the kiln is exposed to strong wind.

33.39. Manufacture of Sugar, Oils, Alcohol, and Vinegar from Wood

33.39 : 34.6. KATSEN, R., and OTHMER, D. F. **Wood hydrolysis: utilization of waste liquors.** *Industr. Engng. Chem.* (*Industr. Ed.*) 37, 1945 (442–5). [Polytechnic Institute, Brooklyn, N.Y.] P.R. [881].

An earlier paper described a continuous process of wood hydrolysis [cf. *For. Abstr.* 4, (119)]. Further experiments have now been carried out on the waste liquors which were treated under pressure at a temperature which rehydrolyses the sugars to give additional organic acids and furfural. A 15-minute treatment at 100 lb./sq. in. was found to increase the furfural yield by 100–140 per cent. and the organic acids by as much as 14 per cent. By-products were subsequently separated by extraction with high-boiling solvents such as octyl acetate, octyl alcohol, isophorone and furfural. Batch and counter-current extractions indicated that isophorone is the most practical solvent tested for extracting furfural and acetic acid from dilute hydrolysis liquors. A plant process using isophorone is proposed. *From authors' summary.*

33.39 : 12.25. LOUGHRAN, G. A., SOODAK, M., and NORD, F. F. **Fermentation of wood hydrolyzates by yeast and fusaria.** *Arch. Biochem.* 6, 1945 (163–4). L.S. [882].

To determine the amount of ethanol obtainable from carbohydrates (hexoses as well as pentoses) present in wood hydrolysates, a specimen of Douglas Fir hydrolysate was prepared with dilute sulphuric acid. Monthly analyses showed that this hydrolysate gave the following increasing values for total reducing sugars: 5·84 per cent., 6·11 per cent. and 6·48 per cent. The hydrolysates were prepared for yeast fermentation by filtration and neutralization to pH 4·5 by sodium or calcium hydroxide, a further filtration, dilutions up to 1 : 5 and sterilizations under pressure. To 1 litre pretreated hydrolysate were added 1·00g. KNO_3, 1·5 g. KH_2PO_4, 0·75 g. $MgSO_4 \cdot 7H_2O$. The fermentations were effected with 2g. compressed National Grain yeast per 100 cc. at 31° C. and the ethanol yield obtained after 24 hours ranged from 53·8 per cent. to 67·3 per cent. depending on dilution. The yeast-fermented mashes were filtered and concentrated to remove the last traces of alcohol. The concentrates were diluted to their previous volumes and treated with 1–2 g. Norite per 100 cc. They were then inoculated with *Fusarium lini* Bolley. In 16 days a moderate growth was observed at 28° C. The fusarial mats were filtered off and the alcohol determined by dichromate oxidation. From 6 to 26 mg. alcohol were obtained from 100 ml. of solution, equivalent to 2·2 to 4·7 per cent. of the alcohol obtainable from the residual carbohydrate content (calculated as pentose) of these hydrolysates. These preliminary results show that the 'pentose'-alcohol of Douglas Fir hydrolysate is about 1 per cent. of the alcohol obtained from yeast fermentation.

33.39. HARRIS, E. E. **Hydrolysis of wood by percolation with dilute sulfuric acid and the fermentation of the resulting wood liquors.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1446, 1944. pp. 58 + tbls. + figs. P.R. [883].

Using a hydrolysis procedure similar to the

Scholler process, several species of American woods were converted into reducing sugar suitable for fermentation to ethyl alcohol. Softwoods gave a yield of about 50 per cent. reducing sugar, of which 75 to 80 per cent. was fermentable. The figures for hardwoods were 50 per cent. sugar and 50 to 65 per cent. fermentable. Spent turpentine chips from a solvent-extraction process gave 35 to 40 per cent. sugar and 80 per cent. fermentable. A study of the time–temperature–water relationships in wood hydrolysis made it possible to develop a new process for wood hydrolysis which greatly reduced the time required for the Scholler process. Full details are given of the operation of the pilot plant and the fermentation of wood liquors produced. A careful study of the data will allow a choice of conditions with a consequent reduction of time, chemicals or steam. *From author's summary.*

33.39 : 12.25. HARRIS, E. E. **Saccharification of wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1475, 1945. pp. 14 + tbls. + plates. P.R. [884].

Samples of various types of Douglas Fir mill waste have been hydrolysed and show that the presence of large percentages of bark is not desirable as it limits the amount of sugar that can be produced per digester and entails the use of further extractions to remove the sugar produced. Mixtures containing hogged mill waste, shavings, and sawdust were found to permit sufficient packing in the digester to give satisfactory yields of sugar per digester charge. Acid-sugar solutions were treated with lime and filtered under conditions which gave low soluble sulphate values and also gave solutions which fermented more readily. Brewers' yeast, started on diluted Louisiana molasses, grew readily on diluted wood-sugar solutions. Yeast produced on wood-sugar gave fermentations that were complete in 6 hours with 0·3 per cent. yeast by weight and in 14 to 20 hours with 0·13 per cent. yeast. *From author's summary.*

33.39. **Tons of vanilla from 'grains' of wood.** *Process Ind. Quart.* 8 (2), 1944 (2–3). L.S. [885].

A brief description is given of the plant and process used in treatment of pulp sludge for production of vanillin. The sludge, which consists of relatively pure basic calcium lignin sulphonate, is recovered from waste sulphite liquors obtained in pulping freshly cut coniferous wood. On desulphonation with hot caustic, the sludge yields true vanillin, a natural product exactly like that obtained from vanilla beans. The remaining steps of the process are (1) solvent extraction of the hot, strongly caustic liquor, (2) separation, by evaporation, of the solvent, which is recycled, and (3) purification of the crude vanillin, which is finally distilled from high-vacuum solid nickel stills as a chemically pure colourless oil. In the final step of the process, the oil is taken up in water and recrystallized as fine needles. These pure vanillin crystals, which melt at about 82° C. (180° F.), are readily acceptable as a flavouring medium in all the uses for which vanilla is customarily used.

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

33.5 (410) : 22.1 : 98.1. WILSON, S. E. **Mining timbers: home supplies and forestry.** *Wood* 10, 1945 (177–9). [886].

Conifer and other poles suitable for pitprops are produced from two distinct silvicultural systems in operation in British woodlands: (1) conifer plantations grown for clear-felling at the pole stage, in areas mostly near the mines where the props will be consumed; (2) thinnings from stands being grown with the main objective of producing mature timber of sawlog dimensions. The low prices ruling at the mines during the inter-war period prevented the full utilization of this home-grown timber except in woodlands close to mining districts. The rapidly increasing consumption of softwoods of pitprop size in the pulp mills of Northern Europe, and the Atlantic States of North America, may soon affect the availability and price of mining timber. Steel is being used in increasing amount for both roof support and props, especially during the war when timber imports were restricted; but wood has marked advantages in several respects, notably in being light in weight for its strength, easily cut by hand tools, extremely adaptable and available in any wanted length. There can be no doubt that large amounts of mining timber will be required in collieries and other mines for many years to come.

33.5 : 98.3 (410). WILSON, S. E. **Mining timbers: supply and demand.** *Wood* 10, 1945 (136–8). [887].

The value (landed) of the total imports of mining timber to Great Britain between the wars varied from 3 to 7¾ million pounds annually, and the price per load has varied from £1·3 to £3 without reference to the volume imported; these price fluctuations were more severe than in other branches of the timber trade. The cost to the consumer of timber used in coal mines was, e.g. in 1936, twice its cost at the ports. Home-grown timber contributed only 10–12 per cent. of the total. The South Wales coalfields obtain their supplies of pitwood shipped green from France and Portugal and pay 8d. per cu. ft. at the mines, while the English mines use peeled pitprops from Norway, Finland and Russia and pay about 1*s*. per cu. ft. delivered.

33.5 (410). WILSON, S. E. **Mining timber in use.** *Wood* 10, 1945 (115–9). [888].

All imported and most home-grown mining timber used in Great Britain is softwood, and round pitprops form the major part of the total consumption. At the working face of the coal seam they have, as a rule, only a short life of a day or two, but timbers used for gateways and main roadways are intended to have a long life, and for this purpose Larch is the most suitable species owing to its great strength and durability. At the coal-face, beams 4 or 5 ft. long, resting on pitprops, are in general use; the consumption of these, mainly in northern coal-fields, is some 30 million pieces a year out of a total of some 250 million pieces of mining timber used annually. Sleepers for the narrow-gauge rail tracks are mostly 3 ft. to 3½ ft. long, and either 6 in. by 3 in. or 5 in. by 2 in. or 2½ in. of softwood or the tougher hardwoods such as Elm or Poplar.

33.5 : 33.36.1. **Report of Committee 7–9—post service records.** *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (239–47). [889].

Details are given on the service records of post installations, representing various species and preservative treatments.

33.8. *Other Manufactured Products*

33.8 (54) : 12.25. REHMAN, M. A., and ISHAQ, S. M. **Indian woods for pencil making.** *Indian For. Leafl.* (*Utilization*) No. 66, 1945. pp. 8. [Forest Research Institute, Dehra Dun.] P.R. [890].

Juniperus macropoda from Baluchistan is the only native timber suitable for the manufacture of first-class pencils, while eighteen species of timber are listed as suitable for second-grade pencils. Treatments for softening the wood to improve whittling quality were tested on nine of these timbers, but so far no entirely satisfactory method has been found and experiments are still in progress.

33.8 : 12.26–8 : 32.91.4. KHUKHRYANSKI, P. N. Podshipniki iz pressovannoy berezȳ na telezhkakh lesovoznykh uzkokoleynȳkh zheleznȳkh dorog. **[Bearings made from compressed Birch on trucks on narrow gauge forest railways.]** *Lesnaya Prom.* No. 1–2, 1944 (7–8). [Russ.russ.] [891].

Cast-iron bearings used on trucks on narrow-gauge railways were found to deteriorate rapidly when exposed to sandy dust; the trucks carried loads of 3–3·5 cu. m., and the pressure on each bearing of the undercarriage was 9–10 kg./sq. cm. Wooden bearings made from Birch blocks steamed at 100° C. for 3–4 hours, compressed radially 35–40 per cent. and then dried for a day at 70° to 80° C., were equally as efficient as the cast-iron bearings under similar working conditions; when exposed to sand the wooden bearings were slightly grooved while the iron bearings rapidly burned and failed. Of two types of wooden bearings, those with the fibres arranged perpendicular to the axle were more durable than those with the fibres arranged longitudinally, parallel to the axle.

33.9. *Grading and Storage of Converted Timber*

33.91 (4 : 7) : 31.8. THUNELL, B., and HJERTSTRAND, Å. Översikt över utländska klassificerings-bestämmelser för konstruktionsvirke. **[Review of foreign classifications for constructional timber.]** *Circ. svenska Träforsk Inst.* No. 3, 1944. pp. [4]. [Sw.] *Repr.* from *Trävaruindustrien* No. 23, 1944. P.R. [892].

Includes comparative data on standard timber specifications in various European countries and in North America. Diagrams are given to illustrate the measurement of timber defects (knots, fissures, blemishes, sloping fibre, bending) in England, Germany, and the United States.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.23. Wood Ash. Potash

34.23. **Ash in wood.** *Paper Tr. J.* 120 (13), 1945 (33). P.R. [893].

Details of a tentative standard for the calculation of the percentage of ash, based on the weight of wood and determined to two places of decimals. The test specimen is 2 g. of wood for each determination. The procedure of drying and weighing at each stage of the test is described in detail.

34.23. MILTON, C. **Stones from trees.** *Sci. Mon., Wash.* 59, 1944 (421–3). P.R. [894].

Stones, caused by the fusion of ash while enveloped in carbon dioxide from surrounding burning wood, have been found recently in the Grand Canyon of Arizona, and in northern Idaho and southern Washington. Chemical analysis shows that these stones are composed of a double carbonate of potassium and calcium, unknown as a naturally-occurring mineral except in these stones.

34.24. Tanning Materials

34.24 (57) : 12.26–8 : 12.19.1. GAMAYUNOVA, A. D. Dubil'nȳe rasteniya dolinȳ r. Sȳr-Dar'i. [**Tannin-bearing plants of the valley of the River Syr-Darya.**] *Sovetsk. Bot.* No. 2, 1944 (45–51). [Russ.] O.B.D. [895].

A survey was made of tannin bearing plants in seven provinces of the Syr-Darya valley to estimate the supply of raw material and to determine the possibility of establishing centres for the collection and preparation of tanstuffs in a region already worked for building material and fuel wood. The chief sources of tanbark are willow forests containing *Salix songarica* Anderss., *S. caspica* Pall., *S. cinerea* L., *S. wilhelmsiana* M.B., and *S. alba* L. Felling areas in riparian forests and on land subject to flooding are selected under rules that maintain protection against erosion. Felling and bark stripping are done before the floods of April and June and again after the water has subsided in August. The riparian vegetation of the Syr Darya is classed in three categories, floodland, land rarely flooded, and terraces. The soils and plant communities are briefly described and reference is made to plants, other than trees, the roots of which yield tannin.

34.25. Decorative Branches. Medicinal Plants

34.25. GROSSENBACHER, K. A., SPURR, S. H., and VLAMIS, J. **Lasting properties of cut foliage.** *J. Arnold Arbor.* 26, 1945 (214–28). [896].

Cut foliage of more than one hundred representative species of the northeastern United States, western Europe, Asia, and the tropics was tested and classified as to its lasting qualities, both with and without a supply of water. Conifers proved to be greatly superior to hardwoods in this respect, and plants of the same genus tended to have similar lasting qualities regardless of their geographic origin. The range in lasting qualities of tropical species was much the same as that of temperate plants. In the tropics, however, because of the large size and weight of many of the leaves, abnormal appearance of drying foliage was often first manifested by marked wilting of the petioles and consequent leaf drooping, rather than by a change in the leaf itself.

A number of factors involving the selection and handling of cut foliage affects its lasting qualities. These factors are discussed. The reduction of water loss by means of a non-toxic coating will materially increase the life of cut foliage. *From authors' summary.*

34.25 : 01.6. MOREAU, R. E. **An annotated bibliography of Cinchona-growing from 1883–1943.** East African Agricultural Research Institute, Amani, Tanganyika Territory. 1945. pp. 41. [897].

The bibliography is in two parts. The first is a list, arranged by countries, of the annual reports of departments or stations that regularly or frequently contain references to Cinchona. The second consists of individual references, arranged alphabetically by authors. *From author's summary.*

34.25 (66.99) : 12.26–8. FARIA, F. R. Sôbre o desenvolvimento da cultura das quineiras. [**On the development of *Cinchona* cultivation.**] *Rev. agron., Lisboa* 30, 1942 (371–5). [Port.] E.M.B. [898].

The wartime difficulty in obtaining quinine for the treatment of malaria has again focussed attention on the possibility of growing *Cinchona* on a commercial scale in the Portuguese colonies of S. Tomé, Cape Verde and Timor. Conditions in S. Tomé are particularly suitable for the cultivation of *Cinchona* spp. The

species most rich in active principles is *C. calisaya* and its varieties. Maximum alkaloid production takes place in 4- to 9-year-old plants, or, in the case of plants cultivated from cuttings, those 3 to 4 years old. The quantity and quality of the alkaloids produced varies with the time of year. Production seems to be highest in trees of rapid and vigorous growth. It is recommended that a study should be made of high-yielding species or varieties of *Cinchona* which are suited to the soils and elevations of S. Tomé.

34.25 : 12.26–8 : 12.19 : 45.3. FALLON, F. *Derris* et *Lonchocarpus*: insecticides végétaux. **[*Derris* and *Lonchocarpus*: plant insecticides.]** *Bull. agric. Congo belge* 32, 1941 (112–25). [F.] [899].

The article gives a general description of the genera *Derris* and *Lonchocarpus* and their more important species, their geographical distribution, cultivation, harvesting, yield, chemical composition of the roots, preparation of insecticides, and commercial exploitation. From statistics up to 1938 it is shown that the U.S.A. imported half of the world's production. It was suggested in 1941 that *Derris* and *Lonchocarpus* might be used for interplanting in rubber plantations in the Belgian Congo.

34.25 : 12.26–8 : 45.3. TILEMANS, E. Les légumineuses insecticides. **[Leguminous insecticides.]** *Bull. agric. Congo belge* 32, 1941 (126–93). [F.afrik.] [900].

The article gives a general account of the species of *Derris*, *Lonchocarpus*, *Tephrosia*, *Millettia* and *Mundulea*, the roots of which contain appreciable quantities of rotenone, and are used in the preparation of insecticides. Other sections deal with environment, cultivation, selection of strains, fertilizers, harvesting and preparation of roots, packing and storage, commerce. The chemistry and method of extraction are dealt with in detail, as are the insecticidal action, biological assay and application of the extractives. Another section lists a number of injurious insects and the effect on them of the application of rotenone-base powders. It is suggested that the cultivation of the indigenous species might with advantage be undertaken in Belgian Congo.

34.25 : 12.26–8. PERESLEGIN, N. V. **Nature and action of Chinese Schisandra (*Schizandra chinensis*).** *Farmakol. i. Toksikol.* 7 (3), 1944 (11–3). Chem. Abstr. 39 (3123). P.R. [901].

The essential oil of Chinese Schisandra, (*Schizandra chinesis*) is not the active ingredient; the fruit (2 per cent. oil) is active, while the bark (3 per cent. oil) is inactive as a respiratory stimulant. The fruit has 8·5 per cent. acidity, due mainly to citric, malic and tartaric acids. A 10-per-cent. solution of these acids, in the same proportion as in the fruit, injected intravenously into rabbits (dose 1 cc./kg.) caused a sharp increase in respiration rate.

34.26. Resin. Turpentine. Oils. Rubber. Latex

34.26 : 12.25. WESTGATE, M. W. **Brief notes on Pinyon resin and stick lac from Arizona.** *Circ. nat. Paint Varnish Ass.* (*Sci. Sect.*) No. 665, 1943 (190–8). [902].

Samples of the gum exudation from Piñon Pine (*Pinus edulis*) were separated into several fractions and each analysed for its main physical and chemical characteristics. The tests are summarized, the derivatives made from the products of this gum being described and given in the form of a flowsheet. The outstanding result of the investigation was the markedly superior resistance to the action of cold and hot water offered by a pale resin of Piñon Pine as compared with ordinary rosin.

34.26 : 34.6 : 33.32. COLLINS, T. T., jr., and SCHMITT, M. G. **Sulphate turpentine.** *Paper Ind.* 26, 1944–45 (1136–41; 1573–8). L.S. [903].

The authors review at some length the literature concerning the history and economics of sulphate turpentine recovery and describe the methods of collection, separation, purification and the uses of turpentine produced as a by-product in soda, sulphate, and steam groundwood pulp manufacture. *From authors' summary.*

34.26 : 12.26–8 (62.4). GRINDLEY, D. N. **Investigation of the seed oils of some Sudan Mimosaceae.** *J. Soc. chem. Ind., Lond.* 64, 1945 (152). P.R. [904].

A brief description of the characteristics, principal constants and approximate compositions of the fixed fatty acids of *Acacia albida*, *A. sieberiana*, *A. verek*, *A. mellifera*, *A. seyal*, *A. arabica* and *Albizzia lebbek*. They contain a high percentage of unsaponifiable matter and no linoleic acid could be detected. The mixed unsaponifiable matter from these oils had an iodine value of 115 as determined by the Rosenmund and Kuhnenn method.

34.26 : 12.26–8. HAAGEN-SMIT, A. J., and SIU, R. **Chemical investigations in Guayule. I. Essential oil of Guayule** (*Parthenium argentatum*) **Gray.** *J. Amer. chem. Soc.* 66, 1944 (2068–74). P.R. [905].

As a result of tests on Guayule it was found that the leaves contain on the fresh-weight basis 1·04 per cent. essential oil, the flowers 0·75 per cent., the bark 0·24 per cent., and the wood 0·11 per cent. The average yield for the whole plant is 0·45 per cent. The oil was separated into 45 fractions divided into five large groups 72·6 per cent. terpenes, 5·8 per cent. oxygenated terpenes, 9·3 per cent. sesquiterpenes, 6·3 per cent. oxygenated sesquiterpenes and 5 per cent. residue. The compounds and approximate amounts identified are 60 per cent. α-pinene, 9 per cent. dipentene, 8 per cent. cadinene, 6 per cent. di-, tri- and higher terpenaceous compounds, 4 per cent. elemol-like sesquiterpene alcohol, 4 per cent. phellandral (probably), 3 per cent. sesquiterpene alcohol with an azulene nucleus, 2 per cent. guajene-like sesquiterpene, 2 per cent. ketone or aldehyde, 2 per cent. β-pinene and small amounts of an easily oxidizable terpene. *From authors' summary.*

34.26 : 12.26–8 : 12.11.11. VENKATA RAO, C., NARASINGA RAO, M., and VENKATESWARLU, A. **Oil from the seeds of *Bombax malabaricum*.** *J. Indian chem. Soc.* 20, 1943 (403–6). [Andhra University, Guntur.] O.R.S. [906].

The oil from the seeds of *Bombax malabaricum* (Kapok oil) contains 94·8 per cent. insoluble mixed fatty acids composed of 57 per cent. of solid acids and 43 per cent. of liquid acids. The composition of the fatty acids is myristic acid 1·2, palmitic acid 23·6, arachidic acid 2·8, oleic acid 64·9, and linoleic acid 7·5 per cent. The seed cake contains 34·4 per cent. of crude protein.

34.26 : 12.11.11 : 12.26–8. SABOOR, M. A. **The composition of the fatty acids of the seed fat of *Lophira alata* (Ochnaceae).** *J. Indian chem. Soc.* 21, 1944 (303–6). [Dacca Intermediate College, Kamna, Dacca.] O.R.S. [907].

The mixed fatty acids of the oil from the seeds of *Lophira alata* have been separated into solid (41·9 per cent.) and liquid acids (58·1 per cent.). A detailed analysis is given. It is suggested that the best use for the oil is not as a direct soap-making material, but as a diluent in the various oils and fats used in soap manufacture.

34.26 : 12.26–8. NADKARNI, M. D., AIRAN, J. W., and SHAH, S. V. **Fatty oils from seeds of *Mappia foetida* (Olacaceae).** *Curr. Sci.* 13, 1944 (233). L.S. [908].

Seeds of the dry ripe fruits of *M. foetida*, collected from the Dajipur forests in the Western Ghats, were crushed and the oil extracted with benzine. The solvent was then removed by distillation and the last traces under vacuum. The oil is reddish yellow and has a slight fluorescence; its physical and chemical constants are given.

34.26 : 12.26–8. PYE, C. R. **Component acids of two lesser-known paint oils.** *Paint Technol.* 10, 1945 (113–4). P.R. [909].

Niger seed oil from *Guizotia abyssinica* (Compositae) and Stillingia oil from *Stillingia sebifera* (= *Sapium sebiferum*) (Euphorbiaceae) were tested and found to be suitable for varnish and stand oil production. Data on saponification, iodine values, free fatty acids (as oleic) and refractive index (20° C.), and the characteristics of mixed fatty, 'solid' and 'liquid' acids are tabulated for both oils.

34.26 : 12.26–8 (54.8). SASTRY, S. G. **Mysore Linaloe oil.** *J. sci. industr. Res., India* 3, 1945 (516–8). I.H. [910].

A plantation of *Bursera delpechiana* started in Mysore State, about 11 miles from Bangalore, from Mexican seed has shown excellent growth. The essential oil obtained from the wood and fruits of this species is of commercial importance in the perfumery industry. The oil distilled in Mysore State from the berries and husks of the Linaloe tree differs to some extent in chemical and physical constants from the normal Mexican oil which is distilled mainly from the heartwood of the tree. The higher ester content of the Mysore oil (chiefly linalyl acetate) is welcomed by blenders of perfumes, but the wood oil does not resinify so easily and has better keeping qualities. Berries collected in Mysore yield up to 18 per cent. of essential oil, the main constituent of which is linalol. As the trees grow older and as the estate expands further, it is likely that essential oil will be distilled also from the wood of this species in Mysore.

34.26 : 12.26–8 (66.68). CHEVALIER, A. Explorations botaniques à la recherche de nouvelles plantes à caoutchouc dans la période 1898–1914 et description d'une plante laticifère

africaine: *Vilbouchevitchia atro-purpurea* gen. et sp. nov. **[Botanical expeditions in search of new rubber-bearing plants in the period 1898–1914 and description of an African latex-producing plant, *Vilbouchevitchia atro-purpurea* gen. et sp. nov.]** *Boissiera* 7, 1943 (248–57). [F.] K. [911].

The writer of this article made a number of expeditions to Western and Central Africa in search of latex-bearing plants, but the success of plantation-grown *Hevea* over all other species, turned attention from the subject, and his notes have remained unpublished for thirty-five years. The plant described was discovered in 1907, and represents a new genus and species. It is a woody climber, sometimes reaching as high as 25 m. in trees and double or treble that length on the ground, found on the Ivory Coast in dense forest.

34.26 (54) : 12.26–8 : 12.11.11. PUNTAMBEKAR, S. V., and KRISHNA, S. **Latex of some indigenous rubber yielding plants. Part I. *Excaecaria agallocha* Linn.** *J. Indian chem. Soc.* 20, 1943 (178–80). [Forest Research Institute, Dehra Dun.] O.R.S. [912].

Excaecaria agallocha L. is a small evergreen bushy tree of the coastal forests of Eastern India; it is very common in Sundarbans and also occurs in the Godavari and Kistna deltas. The latex has been found to contain a fat, resin esters, resenes, rubber proteins, crude fibre and inorganic matter. The chemical composition is as follows: water 62, water-solubles 4, ash 1·7, fibre 1·7, proteins 7·9, fat and resin esters 8·6, resenes 11·4, rubber 2·7 per cent.

34.26 (72) : 12.26–8. LUNDELL, C. L. ***Cnidoscolus elasticus*, the source of highland Chilte, a remarkable new rubber yielding tree from the states of Durango and Sinaloa, Mexico.** *Field & Lab.* 12, 1944 (33–8). Biol. Abstr. 19 (14305). [913].

34.27. Seeds. Fruits

34.27 : 12.26–8. WHITE, C. T. **The Algaroba Bean or Mesquite as a pest plant.** *Qd. agric. J.* 58, 1944 (360–1). L.S. [914].

Algaroba (*Prosopis juliflora*) was introduced into Queensland many years ago from Hawaii where the species is regarded as a valuable forage plant. However, since conditions in Queensland are more akin to those of Texas, Arizona and New Mexico where the plant is a serious pest responsible for a material loss in potential meat production, the Queensland Department of Agriculture and Stock is opposed to the planting of Algaroba in the pastoral districts of Queensland.

34.6. *Utilization of Logging and Milling Waste*

34.6 : 38.2. **Sawdust fill used under concrete floor.** *Engng. News-Rec.* 134, 1945 (102). P.R. [915].

When the upper floor of an existing brick building was being converted into a cafeteria in Illinois, sawdust and wood shavings were used as filling under a new concrete floor. The sawdust was soaked for several hours in water, compacted into place with wooden hand tampers and crowned about 1½ in. above the top flange of the beams. A single layer of bitumen-impregnated paper was then placed over the sawdust and the concrete laid on the top.

34.6 (73) : 33.39. **Tires from wood waste.** *Timberman* 46 (6), 1944–45 (94–6). [916].

At Bellingham, Washington, a plant is operating to extract ethyl alcohol from waste pulping liquors and another is being constructed at Springfield, Oregon, to extract sugar from wood chips, ferment the product and distil it to ethyl alcohol. 15,000–20,000 gals. of this alcohol a day is being used at Los Angeles in making styrene by combining alcohol and benzol. Styrene is one of the two basic ingredients of synthetic rubber. Rayon, another product of wood, is being used increasingly as tyre cord fabric.

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

38.1 : 33.3. BEIJERINCK, M. G. **Coating and fixing material.** *Belg. Patent* No. 447,217, Oct. 31, 1942. Chem. Abstr. 39 (1036). P.R. [917].

Wood is ground to fibres about 10 mm. long (0–10 mm.) and mixed with agglutinants such as cellulose adhesive and (if required) other binders, preservatives and colouring materials. In use the mixture is mixed with water to form a pulp which is spread over the surface to be coated, as a heat-insulating and sound-proofing coating.

38.2 : 33.15. JANOSI, K. L. E. DE. **Prefabrication of floors: new manufacturing ideas; insulated panels of plywood; long life and removal value.** *Timb. Tr. J.* 173, 1945 (525–6). [918].

Prefabricated flooring in the form of large plywood panels with alternative methods of fixing and joining is described, and its advantages urged; amongst these is ease of transference if the flooring outlasts temporary houses.

38.3. SMITH, A. K. **Timber connectors in highway structures.** *B.C. Lumberm.* 29 (4), 1945 (40–1, 104). [919].

A description is given of the three types of timber connectors most generally used in timber road structures, namely spike grids, split rings and shear plates. The development of these connectors has enabled engineers to design a number of economical timber structures ranging from framed trestle bents 15 ft. apart, to through trusses of 210-ft. clear span, and arches of 200-ft. span, and has made possible the construction by the U.S. Navy of airship hangars which are the largest clear-span timber structures ever built, and which could not have been built without their use. Descriptions are given of several of the timber bridges on the Alaska Highway, which were constructed with the aid of timber connectors. By their use, the amount of metal required may be reduced by as much as 30 per cent. and a substantial saving is also effected in timber.

4. FOREST INJURIES AND PROTECTION

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42 : 23.27. ARMSTRONG, N. **Emergency treatment for trees injured by ice, wind and lightning.** With discussion. *Proc. 20th nat. Shade Tree Conf.* 1944 (32–6). [920].

Treatment recommended for injured trees consists in careful removal of broken branches, bark-tracing and painting of rips in the bark, and use of bolts if branches have been split or crotches opened. If the end of a branch is broken, it is recommended to cut back to a good lateral if this is available, taking care to make the cut at an angle which will permit complete healing. Many trees which have been uprooted can be successfully re-set, excepting hard Pines. Reset trees need ample watering for two years.

42.2. *Temperature Influences*

42.21 : 12.25 (43.1–5) : 23.21 : 12.25. EMEIS, R. W. Notizen über das Verhalten unserer Ausländer in Schleswig-Holstein. [**Notes on the behaviour of exotics in Schleswig-Holstein.**] *Mitt. dtsch. dendrol. Ges.* 54, 1941 (13–4) [G.] K. [921].

Notes on the effects of the exceptionally cold winter of 1939–40 on various exotics in Schleswig-Holstein. Species which proved very hardy and suffered little damage were *Thuja occidentalis*, North American species of *Abies* and *Tsuga*, *Pseudotsuga taxifolia*, Japanese varieties of *Picea*, *Abies*, *Larix*, *Thujopsis*, *Cryptomeria* and *Chamaecyparis*. The southern European species *Abies cephalonica* and *Picea omorica* and the Californian *Sequoia gigantea* at Weinheim and Württemberg, survived without damage. The last-named species lost all its needles (as it did in 1929) but was green again next year.

42.5 : 12.26–8 : 21.3. BRITO DOS SANTOS, J. O problema da nutrição do sobreiro. [**The problem of the nutrition of the Cork Oak.**] *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (447–8). [Port.] E.M.B. [922].

Some manifestations of poor growth and even certain defects in the bark of the Cork Oak (*Quercus suber*) seem to be the results of deficient or badly balanced nutrition. In order to avoid or attenuate these deficiencies or faults in nutrition it is essential to determine the consequences arising from a lack of any of the essential elements and to carry out intensive investigations on the nutritive processes of the tree. With this object in view, experiments were undertaken with small trees grown either in liquid media containing in solution the substances supposed to be indispensable, or in fine sand supplied with nutritive solutions from which particular substances had been omitted. Chemical analyses of the soil in natural Cork Oak forests and of the principal tissues of the plant completed the investigations.

43. FOREST FIRES

43.1. *Protective Measures*

43.1 (75.5). ARTMAN, J. O., and DEAN, G. W. **Forest fire control in Virginia.** *J. For.* 43, 1945 (393–7). [Tennessee Valley Authority.] [923].

Thirty years of forest fire protection in Virginia have produced results which are unique among southern states. In the past 10

years the fire incidence has been only 0·19 fires per thousand acres protected. Only 0·67 per cent. of the 11,503,204 acres protected has been burned each year and the average fire has been kept down to 35 acres. The annual cost is 1·1 cents per acre protected. This success is attributed principally to constant emphasis on prevention, adherence to a policy which discourages the use of state and federal funds in areas where local funds are not made available, administration of the fire-control organization at the county level, prompt and just enforcement of forest fire laws.

43.1 (79.6) : 06.1. **Genesis and achievements of the Southern Idaho Timber Protective Association.** *Timberman* 46 (7, 8), 1944–45 (50–1, 76, 78, 80; 62–3, 68, 70, 72). [924].

These two articles give an account of the origin, development and work of the Southern Idaho Timber Protective Association and of its influence in promoting State forestry legislation. The Association co-operates closely with the U.S. Forest Service.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.2. *Parasitic Higher Plants*

44.2 (54.1) : 12.26–8 : 45.2. DAVIDSON, D. A. G. **Loranthus attack in Sal plantations.** *Indian For.* 71, 1945 (181–2). [Jalpaiguri Forest Division, Bengal.] [925].

It was observed in 1941 that the Sal (*Shorea robusta*) plantations of the Moraghat Reserve of Jalpaiguri Forest Division, Bengal, were heavily infested with Loranthus (*Macrosolen cochinchinensis* and *Loranthus scurrula*), which is spread chiefly by means of flowerpeckers (*Diciaedae*). As a remedy the infested branches were cut in the cold weather of 1941–42, 1942–43, 1943–44, and infestation is now on a much reduced scale. The average cost of cutting out the Loranthus was one anna per clump. Infested trees were strong and healthy, although there was a tendency to epicormic branching in some of the older plantations. No trees died as a result of the attack.

44.3. *Fungi*

44.3 (73) : 42 : 31.42 : 12.21. BAXTER, D. V. **Pathology in forest practice.** John Wiley and Sons Inc., New York. Chapman and Hall Ltd., London. 1943. pp. xi + 618. [School of Forestry and Conservation, Univ. of Michigan]. Price $5·50. [926].

This book is a combination of a descriptive handbook in which diseases are dealt with seriatim and a treatise to demonstrate the principles of pathology and mycology in relation to silviculture and utilization. It is an attempt to combine in one volume a systematic description of diseases, a technical handbook giving details of purely practical methods, and an account of the general principles which determine pathological developments. A short account is given of the morphology and habit of fungi which cause disease, with keys for the identification of rust fungi and the wood-decaying Hymenomycetes. The relation of site and cultural practice to the incidence of disease is discussed in connexion with the nursery, plantations (i.e. the younger crops) and the mature forest. The stress laid on cultural practice in relation to disease control is good and provides a new departure in text-books on forest pathology. The relation between site characteristics and the occurrence of disease receives less attention. An account is given of fungi and phanerogamic parasites as causes of disease in mature forest, the various forest regions of the U.S.A. being dealt with separately, and there is a chapter on the care of shade and park trees. The final chapters deal with the handling and treatment of forest products in relation to stains and decay.

44.3 : 12.11.3 : 12.11.22. RIKER, A. J. **Some possibilities for developing resistance to disease in trees.** *Amer. Nurserym.* 81 (12), 1945 (5–7). [Univ. of Wisconsin.] [927].

Among the best general means for securing disease resistance are the selection of individuals, of both local and foreign origin, with desirable characters including disease resistance, and inducing variations in them, mainly by cross-pollination and also by treatment with ultra-violet light and with colchicine; the best individuals are again selected and the process continued. The desired result may be obtained more rapidly if the selected plants can be reproduced vegetatively, as with seeds quite a number of successive generations are necessary to stabilize a desired character.

Promising work is being done in the United States in the production of disease-resistant strains of Chestnut, Elm and White Pine, and a rust-resistant strain of Red Cedar (Berg's rust-resistant variety of *Juniperus virginiana*) has been developed and is available commercially.

At the Griffith State nursery, Wisconsin, 1,000 grafts and 10,000 seedlings of White Pine are being tested, the progeny of 163 trees selected for resistance to heavy natural infection of blister rust. Experiments in rooting of cuttings from young White Pine have given 40 to 50 per cent. success, and somewhat better results have been obtained by treating the cuttings with indolebutyric acid, 1 : 5,000 for 6 hours. Cuttings from rapidly growing, vigorous shoots have been found to root less easily than those from slower-growing shoots.

44.3 : 23.27. YOUNG, H. C. **Fungicides for the post-war period.** With discussion. *Proc. 20th nat. Shade Tree Conf.* 1944 (90–7). [Ohio Agricultural Exp. Sta., Wooster, Ohio.] [928].

Up to the present, Bordeaux mixture and sulphur in one form or another have been the leading fungicides. Apart from the fact that both cause considerable injury to trees, their incompatibility with many of the more recently developed and important insecticides makes it necessary to find substitutes for them. New developments include three promising groups: (1) metal salts of thiocarbamic acids, of which three have so far been extensively tested, i.e. Fermate, Methasan and Dithane, (2) organic mercuries including Puratized, (3) quinone groupings. All of these are compatible with a wide range of insecticides. The health and vigour of foliage sprayed with these materials is exceptionally good.

44.3 : 12.11.3 : 12.21 : 12.25. RICE, M. A. **The cytology of host-parasite relations.** *Bot. Rev.* 11, 1945 (288–98). [929].

A review of papers published on the subject in the past ten years. Reference is made to the work of Pierson and Buchanan (1938) with seedlings of *Pinus strobus* and *Cronartium ribicola*, which showed that needles of the current season are least susceptible, those of the second and third seasons are highest in susceptibility and those of the fourth season are intermediate. This ratio corresponds to canker development, for most cankers are formed on second- and third-season internodes. McKenzie reported in 1942 on infections of *Pinus sylvestris*, *P. banksiana* and *P. rigida* with *Cronartium quercuum* and recognized 3 types of host-plant reactions: defoliation without permanent injury, death of leader, and formation of galls. In the first stage the rust mycelium is checked by a cork layer, in the second mycelium penetrates the cork tissue, and, if it persists in living tissue, produces haustoria.

44.3 : 12.25 : 12.21. TINT, H. **Studies in the Fusarium damping-off of conifers. I. The comparative virulence of certain Fusaria. II. Relation of age of host, pH, and some nutritional factors to pathogenicity of Fusarium.** *Phytopathology* 35, 1945 (421–57). [Botanical Laboratory, Univ. of Pennsylvania, Philadelphia, Pa.] [930].

Four fungi, used as standards, and monosporous cultures of 25 Fusarium lines were tested for ability to cause damping-off of coniferous species. Losses are tabulated as (1) emergence loss, including seed decay and destruction of radicles before emergence of seedlings from the substrate, and (2) post-emergence loss, including normal damping-off, top damping-off, and all root-rot fatal before the termination of the experiment.

In liquid-culture inoculation tests in glass tubes, 6 out of 12 lines of Fusarium tested on *Pinus resinosa* seedlings caused complete loss. All the lines were tested in quartz-sand cultures of *P. resinosa* seedlings. About half of the Fusaria reduced emergence significantly compared with the control, and all save one caused heavy post-emergence loss. Of the standard lines: *Sclerotium bataticola* did not lower emergence but caused high post-emergence losses; *Rhizoctonia solani* effected heavy losses in both categories; *Pytium ultimum* and *Penicillium* spp. did not cause significant losses of either kind. The relative virulence of 15 Fusarium lines and four standard cultures was determined, and the range of the susceptibility of the hosts to the entire group of damping-off fungi was ascertained. A number of the Fusarium lines equalled and occasionally exceeded in virulence the culture of *Pythium* and *Rhizoctonia*. *Sclerotium bataticola* caused the least emergence loss, but post-emergence attack was relatively high. *Pinus resinosa* and *Pseudotsuga taxifolia* were the two species most susceptible to both phases of the disease. *P. ponderosa* had the least emergence loss, and *P. pungens* the least post-emergence loss. *From author's summary.*

44.3 : 12.25 : 12.21. WATERMAN, A. M. **Tip blight of species of *Abies* caused by a new species of *Rehmiellopsis*.** *J. agric. Res.* 70, 1945 (315–37). O.R.E. [931].

A tip blight of native trees of *Abies balsamea* in northern New England and of ornamental

trees of *A. cephalonica* in southern New England and *A. concolor* in New England and New York is caused by *Rehmiellopsis balsameae*, a new species. The disease in many respects resembles that caused by *R. abietis* in Europe on *A. alba*, *A. nobilis*, *A. pinsapo*, *A. nordmanniana*, *A. pindrow*, *A. cephalonica*, and *A. sibirica* and in British Columbia on *A. lasiocarpa*.

The needles of the current season's growth are attacked by the disease, and a dieback of terminal or lateral shoots may result. Cankers are sometimes formed on twigs of *A. concolor* at the base of infected needles.

Infection takes place early in the spring just as the new growth is developing. The fruiting bodies of *Rehmiellopsis balsamea* begin to form soon after infection, but the spores do not mature until the following spring. No imperfect stage of *R. balsamae* has been observed.

Inoculation experiments proved the pathogenicity of *R. balsameae* on *Abies concolor* and also showed that *A. fraseri* is susceptible. Small nursery trees of *A. fraseri*, *A. nobilis*, and *A. holophylla*, planted in an area of infected trees of *A. concolor*, proved susceptible to natural infection. Cross infection from *A. balsamea* to *A. concolor* was obtained by planting a young tree of the latter species under a heavily infected native Balsam Fir.

The importance of the tip blight as a disease of forest trees is not yet definitely known, but because of its wide distribution on native Balsam Firs, control measures would not be feasible in the forest. On ornamental White Firs, satisfactory control was obtained by three applications of spray at intervals of 12 days, of a 4–4–50 bordeaux mixture to which casein was added as a spreader. The first application of the spray should be made as soon as the new growth begins to emerge from the buds. *Author's summary.*

44.3 (71.6) : 12.25 : 12.21. NOVA SCOTIA. **Report of the Department of Lands and Forests, 1944.** King's Printer, Halifax, N.S. 1945. pp. 181 + plates + tbls. [932].

In some districts of Nova Scotia new shoots of Balsam Fir were found to be attacked by a needle blight caused by the fungus, *Rehmiellopsis bohemica*. This is apparently the first record of the organism in Canada.

A 'red branch' condition of Balsam Fir has been commonly found, without the punctures caused by *Monochamus* feeding. Many of the red needles bore fruiting bodies of *Adelopus balsamicola*, a fungus common on Fir, which is, however, very unlikely to be responsible for the death of branches. A small canker was found but no causal organism was identified. The condition may have been caused by the girdling fungus, *Valsa friesii* (pp. 59–60).

44.3 (79.4) : 12.25 : 12.26–8 : 12.21. KIMMEY, J. W. **The seasonal development and defoliating effect of *Cronartium ribicola* on naturally infected *Ribes roezli* and *R. nevadense*.** *Phytopathology* 35, 1945 (406–16). [U.S. Division of Forest Pathology.] [933].

As an aid to planning control of White Pine blister rust in the California Sugar Pine region, observations were made on the development and defoliating effect of this disease on naturally infected plants of *Ribes roezli* and *R. nevadense* in their native habitat in the Northern Sierra Nevada in 1938, 1941, and 1943. In general, the susceptibility of the two *Ribes* species to infection by the rust was the same as reported from earlier studies in British Columbia and the Pacific Northwest. Although *R. roezli* remained the more susceptible of the two species and its infected leaf areas produced a higher percentage of telium-bearing surface, the premature dropping of its infected leaves still prevented it from being as dangerous a Pine-infecting species as *R. nevadense* per unit of population. In unworked areas of the California Sugar Pine region, however, it is potentially the more dangerous species owing to its greater population. Infected plants of *R. roezli*, growing on moist, shady sites and producing abundant new woody growth, are potentially the most dangerous of this species, since the tip leaves of the current season's growth on such plants are the last to drop in autumn and consequently uredospores and visible telia remain latest on this type of leaf. Many infected leaves of *R. nevadense* were also present on the plants at the time of the first favourable autumnal rains. The time of year when rain occurs of sufficient duration to provide for Pine infection, will determine the success or failure of the rust, from either *Ribes* species, to infect Pines in a given year. *From author's summary.*

44.3 (73) : 12.25 : 12.21. MARTIN, J. F. **Spread of White Pine blister rust during 1944.** *J. For.* 43, 1945 (287–8). [U.S. Bureau of Entomology and Plant Quarantine.] [934].

White Pine blister rust (*Cronartium ribicola*) has been reported from 28 states in the U.S.A. and occurs more or less abundantly in the eastern and western White Pine regions and the northern half of the Sugar Pine region. The chief points of interest in connexion with its spread in 1944 were the finding of infected White Pines (*Pinus strobus*) in 5 new counties in northeastern Iowa, a 65-mile southward extension of the rust on *Ribes* in California, the discovery of infection on *Ribes* in Yellowstone National Park and on *Pinus flexilis* within its natural range. *Ribes* eradication already shows good results. In the protected areas most of the smaller diseased trees have died and disappeared, and cankers resulting from recent infections are scarce.

44.3 : 12.26–8 : 12.21. UNITED STATES. **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 1943.** U.S. Department of Agriculture, Washington, D.C. 1944. pp. 58. [935].

In preliminary tests undertaken in relation to blister-rust control, aqueous ammonium sulphamate showed promise as an effective herbicide on *Ribes roezli*. A portable preheating-type burning torch was tested and successfully used for killing *Ribes* crowns located in rock crevices. Chemicals were tested for enhancing the typical bark discoloration produced by the fungus (*Cronartium ribicola*) round incipient cankers on White Pine (p. 42).

44.3 (81) : 12.26–8 : 12.21. CAMPOS, A. R., and PICKEL, D. B. J. Observaçãoes sobre as doenças e agentes patogênicos das plantas em Pernambuco. [**Observations on the diseases and pathogens of plants in Pernambuco.**] *Rev. Agric., Piracicaba* 20, 1945 (19–38). [Port.] C.G.B. [936].

Includes brief notes on fungous diseases of *Anacardium occidentale, Mangifera indica, Lonchocarpus neuroscapha, Tabebuia chrysotricha, T. araliacea, Anona marcgravii* and *Eucalyptus* spp.

44.3 (83) : 12.26–8 : 12.21. ARENTSEN, S. S. Hongos uredinales que atacan a nuestros cultivos. [**Uredinales that attack cultivated plants in Chile.**] *Agric. tec., Chile* 4 (1), 1944 (54–6). [Span.] [Depto. de Sanidad Vegetal.] I.I.E. [937].

Among the rusts listed in the table which forms the main part of this article are *Melampsora larici-populina* Kleb. on *Populus nigra* var. *italica*, and unidentified species of *Melampsora* on *Populus alba* L. and *Salix nigra* Marsh.

44.3 (78) : 12.26–8 : 12.21. WRIGHT, E. **Damping off in broadleaf nurseries of the Great Plains region.** *J. agric. Res.* 69, 1944 (77–94). O.R.S. [938].

About half of the broadleaved species grown in the Great Plains region are susceptible to damping-off, four of the most important being American Elm (*Ulmus americana*), Siberian Elm (*U. pumila*), Black Locust (*Robinia pseudoacacia*) and Desert Willow (*Chilopsis linearis*). The principal damping-off fungi have been identified as *Rhizoctonia solani* and *Pythium ultimum*. *Fusarium* spp. may also be of occasional importance. Of the broadleaved species tested, Black Locust appeared to be the most susceptible to *P. ultimum* and Desert Willow to *R. solani*. Pathogenicity tests have proved that *P. ultimum* and several strains of *R. solani* are pathogenic to a number of broadleaved species. *R. solani* inoculations appeared to be more successful in unsterilized than in sterilized soil, whereas the opposite was true for *P. ultimum*. *Fusarium* spp. can cause fairly heavy post-emergence damping-off in unsterilized, inoculated soil. The relations of these studies to the control of damping-off is discussed.

44.3 (77.5) : 12.26–8 : 12.21. GREENE, H. C. **Notes on Wisconsin parasitic fungi. IV.** *Farlowia* 1 (4), 1944 (569–81). R.A.M. 24, 1945 (250–1). [939].

Includes records of *Cercospora alni*, n. sp., Chupp & Greene on Alder (*Alnus crispa*) leaves, and *Dicoccum nebulosum* on *Fraxinus americana* in a nursery in the University of Wisconsin arboretum.

44.3 : 12.26–8 : 12.21 : 47. GULYAEV, V. V. Serdtsevinnaya gnil' chernoi ol'khi (*Alnus glutinosa* Gärtn.) v derev'yakh poroslevogo i semennogo proiskhozhdeniya. [**Heart rot of *Alnus glutinosa* Gärtn. in trees of seedling and vegetative origin.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 7, 1939 (99–120). [Russ.] [940].

Heart rot of *Alnus glutinosa* is most often caused by infection with *Fomes igniarius* through unhealed wounds left by dead branches and other mechanical injuries, but in trees of vegetative origin infection also occurs through the parent stump. Trees growing on raised ground are more resistant to heart rot than those

in marshy ground: a well-drained soil is one of the best safeguards against heart rot in this species. External indications of disease are a crooked stem and the present of old wounds and frost cracks and, with trees of seedling origin, the absence of these signs may be taken to indicate freedom from infection.

44.3 : 12.26–8 : 12.21 : 47. ANKUDINOV, A. M. Serdtsevinnaya gnil' osinȳ i merȳ bor'bȳ s nei. **[Heart rot of Aspen and combative measures against it.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 7, 1939 (3–67). [Russ.] [941].

Aspen (*Populus tremula*) is the most widely distributed and one of the fastest-growing forest tree species in the U.S.S.R.; however, it is highly susceptible to heart rot caused by *Fomes igniarius*. This paper reviews the extensive Russian and foreign literature on this subject and presents results of experiments carried out at the forest pathology and mycology laboratories in 'VNIILKh'.

The wood of Aspen is frequently discoloured, and the reddish, orange, pink or brown spots that occur in young trees increase in size with the development of the tree and eventually merge together; the texture of this abnormally coloured wood differs very little from that of normal wood. For the purpose of investigating the cause of discoloration, mycological and microscopic analyses were made on a total of 234 samples representing all shades of abnormally coloured wood, taken from different parts of the tree, and from trees of different ages (1–90 years). Samples of normally coloured wood and of wood in the final stage of rot were also analysed.

The mycological tests on the 234 discoloured wood samples showed that 129 were sterile, 14 had bacterial colonies only, and 91 showed the presence of fungi. The percentage in the third group was relatively high for samples taken in the vicinity of advanced heart rot, and was higher for samples taken from the stump than from other parts of the tree; no samples of discoloured branchwood were included in this group. A fairly high percentage of the samples taken from trees under 10 years of age showed the presence of fungi, but it is suggested that owing to the small size of some of the samples these may have become infected at the time the cultures were made. Bacterial colonies were isolated from a high percentage of the samples of the normally coloured wood. Of the 10 samples of wood in advanced state of rot, 3 were sterile, one had bacterial colonies only, and 6 showed the presence of fungi. The negative reactions in the first four samples is explained by the dying out of the fungal hyphae in the final stage of rot.

The following are the fungi that were isolated from the 91 samples of discoloured wood, with the percentage of each: *Verticillium* (*?robustum*) (15·4 per cent.), *Verticillium* spp. (13·2), *Sclerotium* sp. (13·2), *Torulospora linderi* (9·9), *Macrosporium* sp. (4·4), *Tremella* sp. (4·4), *Cylindrosporium* (*?meridionalis*) (3·3), *Gyrostroma* sp. (2·2), *Cytospora* sp. (2·2), *Mortierella* sp. (2·2), *Armillaria mellea* (1·1), *Phoma* sp. (1·1), *Chaetomium* sp. (1·1), *Sporodesmium* sp. (1·1), *Apiosporium* sp. (1·1), *Torula glutinis* (1·1), and undiagnosed cultures (23·0 per cent.).

Results from the microscopic examination of the 234 abnormally coloured samples showed that 91 contained fungal mycelium. Data are given on the percentages of these showing different stages of cell destruction. The vessels of 228 (98·3 per cent.) of these samples were found to contain tyloses which appear to be characteristic of abnormally coloured Aspen wood. Examination of samples of wood in advanced stage of rot caused by *Fomes igniarius* showed the complete destruction of the cell walls except for the middle lamella and the presence of broken strands of hyphae.

Measurements were also made of the moisture content of abnormally coloured Aspen wood, which was found to be higher than that of sound wood. Samples taken from the neighbourhood of wood in an advanced state of rot had a considerably higher moisture content than those not near it, and the moisture content of samples containing both fungi and bacteria was notably higher than that of sterile samples. From this it was concluded that the discoloration of infected Aspen wood is connected with its higher moisture content. The moisture content in the wood of young Aspen (up to 10 years) was found to be higher than that in older trees, and that in samples taken from stumps of trees in an advanced state of rot was especially high. A definite correlation was found to exist between the degree of discoloration and the presence of fungi, but artificial inoculation of both dead and living Aspen wood with bacterial and fungous cultures failed to produce any considerable degree of discoloration, and

it is concluded that deep discoloration is more likely due to biochemical and physiological causes. The initial reaction of wood to the presence of *Fomes igniarius* seems to be a very slight greeny-brownish discoloration of the wood.

The initial causes of redness in the wood of young Aspens up to 3 years of age are mechanical injuries to the stems and the withering of the top shoots caused by frost, by *Fusicladium radiosum* Lind., or by insects. Red discoloration and heart rot in the wood of older trees result mainly from wounds left by dead branches, which have failed to heal.

Aspen grows best and produces sounder trees on a rich damp soil or well drained clay and seldom does well on a sandy soil.

44.3 : 12.26–8 : 12.21 : 24.2 : 24.51. ERMILOVA, V. S. Prichinȳ razvitiya gnili u osinȳ i merȳ bor'bȳ s nei. [**The causes of rot development in Aspen and combative measures.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 7, 1939 (69–77). [Russ.] [942].

A study was made of the causes and spread of heart rot in Aspen over a period of two years on several stands of 35- to 40-year-old trees in the forests of Tartar A.S.S.P. and on 1,000 trees, 5–12 years old, in the river basin of Kama, Taichersk, some growing in flood land and others on terraces above the flood level. Two hundred of the 1,000 trees had been grown from seed.

It was found that Aspens of both vegetative and seedling origin develop two types of rot, stump rot and stem rot. Stem rot, which develops twice as quickly as stump rot, results mainly from the unhealed wounds left by dead branches, which eventually become infected by *Fomes igniarius*. Sound Aspens of 30–35 years were found to be well pruned to about $\frac{1}{3}$ the height of the tree. Self-pruning depends on forest conditions, and proper thinning and artificial pruning to supplement self-pruning are discussed.

44.3 : 12.26–8 : 12.21. **Leaf scorch of the Plane tree.** *J. Dep. Agric. Vict.* 41, 1943 (553–4). L.S. [943].

The fungous disease known as leaf scorch or anthracnose is caused by *Gloeosporium nervisequum*; it infects the leaves and young twigs of Plane (*Platanus acerifolia*). Pollarding is a common method of control, which should, however, be supplemented by spraying with 4 : 4 : 40 Bordeaux at bud burst and again a week later.

44.3 : 12.26–8 : 12.21. HIRT, R. R., and LOWE, J. L. ***Polyporus versicolor* on Asiatic Chestnut.** *Phytopathology* 35, 1945 (574–5). [New York State College of Forestry, Syracuse, N.Y.] [944].

Polyporus versicolor, commonly associated with the decay of sapwood, causes decay of the heartwood in living Catalpa, Black Cherry (*Prunus serotina*), London Plane (*Platanus orientalis*), Apple, Pear and Plum. Destruction of the heartwood weakens the affected trees and makes them especially susceptible to wind, snow, and ice damage. The fungus has recently been observed in New York State on Asiatic Chestnut (*Castanea* sp.). Rabbits had gnawed the base of the tree some years previously, and the fungus may have entered through these wounds.

44.3 : 12.26–8 : 12.21 : 11.11. TYLER, L. J. **Influence of temperature on the Dutch Elm disease in potted American Elm.** *Phytopathology* 35, 1945 (302–4). [Department of Plant Pathology, Cornell Univ., Ithaca, New York.] [945].

Investigations on the effect of temperature on the pathogenicity of Dutch Elm disease (*Ceratostomella ulmi*) on artificially inoculated potted American Elms (*Ulmus americana* L.) has shown that the range of temperature most favourable to disease development is between 15° and 29° C. High and low temperatures (32° to 37° C. and 9·5° to 12° C.) retarded or even inhibited wilt and almost entirely suppressed the invasive activities of the pathogen.

44.3 : 12.26–8 : 12.21 : 24.51 : 13.2. ZENTMYER, G. A., and WALLACE, P. P. **New research on the Dutch Elm disease.** With discussion. *Proc. 20th nat. Shade Tree Conf.* 1944 (115–21). [Connecticut Agricultural Exp. Sta., New Haven, Conn.] [946].

Much research has been done in recent years on the Dutch Elm disease and the following facts are now established: (*a*) the disease can be controlled by pruning if this is done early enough; (*b*) defoliation of Elms by cankerworm (*Paleacrita vernata*) greatly increases susceptibility to the disease; (*c*) the development of the disease in individual trees is affected by the number of spores with which it is inoculated, and the number of inoculation points. Extensive experiments have shown that the number

of spores with which a tree is inoculated is directly related to the development of the disease. Multiple inoculations were also found to be more effective than single inoculations involving the same number of spores. Research at New Haven into the possibilities of chemotherapy have had interesting results. Nursery Elms have been immunized by injecting them with organic chemicals, and in other cases the disease has been retarded by injection or soil application. In 1941, 13 Elms were injected with hydroquinone before inoculation with a heavy dose of *Ceratostomella ulmi* spores; only 4 of these showed symptoms of disease compared with 100 per cent. disease for 10 water-injected controls and 8 non-injected controls.

44.3 : 12.26–8 : 12.21. CARTER, J. C. **Wetwood of Elm.** With discussion. *Proc. 20th nat. Shade Tree Conf.* 1944 (175–80). [Illinois State Natural History Survey, Urbana, Ill.] [947].

Wetwood of Elm was under investigation in Illinois from 1939 to 1944. It was found that the disease is caused by a bacterium of the genus *Erwinia*, closely related to *E. salicis* which causes the watermark disease of Willow. When wood becomes infected there is an accumulation of sap, producing the water-soaked condition called wetwood. The bacterium, which ferments carbohydrates and other material in the trunk, liberates gas and the gas causes abnormally high sap pressure to develop. Pressures up to 60 lb. per sq. in. have been observed. The gas and sap, under pressure, are frequently forced out through cuts, cracks and other injuries and this bleeding is commonly called flux. Sap from infected tissues has been shown to be toxic to foliage and young shoots. Proper installation of drains often relieves the abnormal internal pressure, and fluxing from wounds and cracks ceases.

44.3 : 12.26–8 : 12.21. SILVEIRA, V. D. Sobre *Corticium salmonicolor* B and Bred., causando una lesão anelar em troncos de *Eucalyptus alba.* [**On *Corticium salmonicolor* B & Bred., causing an annular lesion on the trunk of *Eucalyptus alba.***] *Bol. Soc. brasil. Agron.* 7, 1944 (95–6). [Port.] I.I.E. [948].

Annular lesions on the trunk of *Eucalyptus alba* were found to be caused by the fungus *Corticium salmonicolor* B. & Br. (Telephoraceae; synonyms *C. javanicum* Zimm., *C. zimmermani* Sacc. & Syd., *C. javanicum* (Hen.) S. & S.). Among the other plants known to be susceptible to attack by this fungus are species of *Achras, Annona, Cassia, Cinchona, Erythroxylum, Ficus, Hevea, Populus* and *Thuja.*

44.3 : 12.26–8 : 12.21. WALTER, J. M. **Plane tree disease control.** *For. Leaves* 35 (1), 1945 (7–8). [949].

Experiments carried out during the past five years have shown that the canker stain disease (*Ceratostomella* sp.) of London Plane can be successfully controlled by the following measures: (1) Remove all diseased trees or parts of trees. (2) Avoid all unnecessary mutilation of Plane trees. (3) Before using pruning tools on healthy trees, disinfect the tools and all other equipment that has been in contact with an infected tree. (4) If a wound dressing is necessary, use a gilsonite varnish in which phenylmercury nitrate has been mixed in 0·2 per cent. concentration. (5) As far as possible, restrict pruning of Plane trees to the period from December 1 to February 15.

44.3 (47.3) : 12.26–8 : 12.21. KATTERFEL'D, H. Serdtsevinnaya gnil' i drugie zabolevaniya stvola lipy v Bashkirii. [**Heart rot and other diseases of the stem of Lime in Bashkir.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 7, 1939 (79–98). [Russ.russ.] [950].

A short account of research carried out at the Bashkir forest research station on diseases of the stemwood of Lime. Subjects dealt with are the types of disease, their spread in the tree and in the stand, the degree of damage caused to the wood, the cause of discoloration and rot in heartwood, stump rot, the means of infection, diagnosis of disease from indications on the outside of the tree, economic significance and control measures.

44.3 : 12.25 : 12.21. PORTER, C. L. **A leaf spot of *Ginkgo biloba.*** *Proc. Indiana Acad. Sci.* 53, 1943 (78–80). [Purdue Univ.] L.S. [951].

In the late summer of 1939 a severe epidemic of leaf spot and blight, accompanied by considerable defoliation, was observed on various Ginkgo trees on the Purdue campus. The parenchymatous tissues of the leaf appeared to be the first to disintegrate, followed closely by the palisade layer. Pycnidia bearing *Phyllosticta*-type spores were found in many older lesions on the leaves, and it seems probable that the leaf spot is due to the fungus *Phyllosticta ginkgo.* Efforts to isolate the causal organism,

however, have not been entirely successful. A species of *Gloeosporium* has been repeatedly isolated from necrotic areas, but there is no proof that this organism is associated with the disease.

44.3 : 12.26–8 : 12.21. Nosti, J. La utilización de Heveas empleadas como árboles de sombra. **[The utilization of *Hevea* trees for the provision of shade.]** *Bol. agric. Terr. esp. Golfo de Guinea 1943*, Part 1, [1943?] (7–25 + plates). [Span.] R.A.M. 24, 1945 (140). [952].

The most serious disease of *Hevea* on the island of Fernando Po, where the tree is grown exclusively to provide shade in Cacao plantations, is the root rot caused by *Fomes lignosus*. The fungus spreads from Rubber to Cacao and Coffee in the vicinity and destroys them within a maximum period of two years. Other local hosts of the pathogen include breadfruit (*Artocarpus integer*), Coconut, *Yucca* and *Erythrina* spp.

44.4. *Virus Diseases*

44.4 : 12.26–8 (77.2 : 76.9 : 77.1 : 77.8). [Caldwell, R. M.] **Indiana phloem necrosis.** *Amer. Nurserym.* 81, 1945 (27). [Indiana Exp. Sta., La Fayette.] [953].

The phloem necrosis disease of the American Elm (*Ulmus americana*) has recently spread rapidly in Indiana and neighbouring states. Since the virus is believed to be carried by insects, it is advisable to destroy quickly any diseased trees in areas where the disease is starting, and not to plant American Elms in the area where the disease is most severe. The Chinese Elm (*U. pumila*) and the Slippery Elm (*U. fulva*) are resistant to the disease. It appears possible that some American Elms are resistant to the phloem necrosis and that resistant strains may be propagated either vegetatively or from seeds.

45. DAMAGE BY ANIMALS

45.1. *Mammals*

45.12 (71.1) : 12.25–8 : 13.2 : 12.19. Cowan, I. M. **The ecological relationships of the food of the Columbian black-tailed deer, *Odocoileus hemionus columbianus* (Richardson), in the coast forest region of southern Vancouver Island, British Columbia.** *Ecol. Monogr.* 15, 1945 (109–39). [954].

The coast deer of British Columbia is primarily an inhabitant of pioneer forest communities. Logging may be directly responsible for producing improved conditions for this ungulate. Optimum conditions for coast deer occur where a rolling or broken terrain supports a diversified cover in which young second-growth forests predominate but where blocks of older timber are interspersed. Current reforestation practice with Douglas Fir (*Pseudotsuga taxifolia*) planted at approximately 1,200 per acre provides conditions under which maximum damage by deer can be expected. Where natural or artificial seeding gives rise to seedlings in excess of 12,000 per acre, deer damage is found to be unimportant.

Examination of food plants in the field and in deer stomachs revealed that 67 per cent. of the annual diet consisted of twigs and leaves of trees and shrubs (24 per cent. conifer browse and 43 per cent. deciduous browse). The most important woody species browsed in the Goldstream area were Douglas Fir (*Pseudotsuga taxifolia*), Alder (*Alnus rubra*), Willow (*Salix* sp.), and Cedar (*Thuja plicata*). Browsing upon seedling and second-growth Douglas Fir was particularly severe on inferior forest sites. Two types of Douglas Fir (normal trees and yellow trees) were noted among the natural regeneration on southern Vancouver Island. The latter had a significantly lower palatability than the former. Since Western Hemlock (*Tsuga heterophylla*) is not browsed by deer, it is suggested that this species might be used for artificial reforestation in areas where deer are abundant.

Tables are given showing the relative palatability to deer of plants found in southern Vancouver Island, and the extent to which species in the various communities are utilized —their abundance, period of availability, period of utilization, and importance as deer food. Douglas Fir (as represented by young trees) is the most important single food item in the diet of the Columbian black-tailed deer.

45.2. *Birds*

45.2 : 12.25. Cook, D. B., and Littlefield, E. W. **Grosbeak damage to Scotch Pine.** *J. For.* 43, 1945 (269–72). [New York State Conservation Department, Albany, N.Y.] [955].

An account is given of damage to Scots Pine (*Pinus sylvestris*) in the northeastern United States, by the Pine grosbeak (*Pinicola enucleator*) which in winter feeds on the terminal buds.

So great is this damage, together with that of squirrels and other animals, especially in the Adirondacks, that it may be a sufficient reason for discontinuing the use of Scots Pine for reforestation in that region.

45.3. *Insects*

45.3 : 07.7 : 23.27. MENUSAN, H. **Airplane dusting for insect control.** With discussion. *Proc. 20th nat. Shade Tree Conf.* 1944 (161–9). [Pennsylvania State College, Pa.] [956].

A brief account is given of the use of aeroplane dusting for insect control on plantation crops, orchards and market gardens. For the control of caterpillars, the usual procedure is to dust at the rate of 20 lb. of lead or calcium arsenate per acre, but in heavy forest stands the dosage must be increased to 40 or 60 lb. per acre. The cost of aeroplane dusting ranges from $3 to $7 per acre, and this expense is justifiable only for the protection of particularly valuable timber or the eradication of some isolated insect infestation.

The advantages of aeroplane dusting over ground application are that it is quicker, independent of ground conditions, produces (under ideal conditions) a more uniform coating of dust, and tends to be cheaper where large areas are concerned. The principal disadvantage is that the method cannot be used for small areas. Probably the smallest area which it is now economical to spray or dust from the air is 20 acres. More dust is needed, and even under the best conditions there is considerable drift of the dust cloud which may endanger livestock in neighbouring pastures or kill bees 3 to 6 miles distant from the area treated. In order to avoid too much drifting, dusting is usually done in the morning between 5 and 9, when humidity is high and wind movement is not more than 5 or 6 miles an hour. Better deposits of dust are obtained when the foliage is wet with dew.

In order to overcome dust drift and to obtain better coverage, the use of the autogiro and of oil-coated lead arsenate have been tried. Results with concentrated sprays applied with an autogiro compare favourably with treatment by ground sprayers, and the cost per acre is less. The approximate formula for a concentrated arsenate spray is as follows:—100 lb. lead or calcium arsenate, 5 gals. fish oil, 1 gal. light petroleum oil, 35 gals. water. Spraying gives much better results than dusting.

Aeroplane spraying with D.D.T. (Dichlorodiphenyl-trichloroethane) solutions were carried out during 1944 by the U.S. Department of Agriculture for control of gypsy moth near Scranton, Pennsylvania. The spray was applied to 20 acres at the rate of 5 lb. of actual D.D.T. per acre, on 3rd May. Between that date and 15th June no live gypsy moth larvae were found in the treated plots although many were present in adjacent untreated woodland. This one treatment of D.D.T. not only destroyed all gypsy moth caterpillars but also killed all leaf-feeding insects. No ill effects were observed on the birds.

45.3 : 07.7 : 13.2. UNITED STATES. **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 1943.** U.S. Department of Agriculture, Washington, D.C. 1944. pp. 58. [957].

A biplane and an autogiro were used in spraying 2,047 acres of forest infested with gypsy moth (*Lymantria dispar*). In areas where cattle were present, cryolite was substituted for the more toxic lead arsenate used in previous years, with consequent saving in the erection of fences. The results indicate need for modification of the distributing apparatus used in the biplane to obtain better adherence of insecticide to the leaf surface; but the season's work demonstrated the desirability and practicability of increasing the use of aircraft, especially in rough or mountainous country where application of insecticides from ground sprayers is costly (p. 35).

45.3 : 13.2. UNITED STATES. **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 1944.** U.S. Department of Agriculture, Washington, D.C. 1945. pp. 56. [958].

In an experimental test of DDT against the gypsy moth (*Lymantria dispar*), the insecticide was applied in concentrated spray form, at the rate of 5 lb. per acre, to a 20-acre wood in Pennsylvania and a 5-acre wood in New York, both heavily infested. The spray was applied by a specially constructed spinner-disc apparatus attached to a biplane. Application was made on the Pennsylvania site early in May before leaves had developed or the moths hatched, while in New York treatment was applied after leaves had fully developed and when the defoliators were in the second larval

stage. From a few hours after treatment till the end of June no living gypsy moths were found in either tract. It is believed that, when available for the purpose, DDT applied by aircraft will afford a cheaper and more effective method of control and eradication of gypsy moth than any method previously used (p. 34).

Previously, only dust-type insecticides have been applied from aircraft for the control of gypsy moths, and adherence of dust to foliage has not been satisfactory. During 1944 lead arsenate and cryolite in concentrated spray form were distributed from the spinner-disc apparatus. Mortality of gypsy moths approximated 100 per cent. in all areas treated with lead arsenate, and reasonably satisfactory control was obtained in areas treated with cryolite (p. 35).

45.3 : 13.2. HAMBLETON, E. J. **Experiments with DDT on leaf-cutting ants in Ecuador.** *J. econ. Ent.* 38, 1945 (282). [U.S. Office of Foreign Agricultural Relations.] [959].

Preliminary experiments with DDT on nests of the leaf-cutting ant, *Atta cephalotes* in El Salvador, seem to show that this chemical effects a slight temporary reduction in the activity of a colony, but has no observable toxic effect on the ants.

45.3 : 12.25 : 13.2. **Insect control: pests of Pines.** *Amer. Nurserym.* 81, 10, 1945 (22–3). [960].

Spraying with a summer oil emulsion is recommended for getting rid of Pine-leaf scale (*Chionaspis pinifoliae*). Sprays should not be applied when the temperature is above 80° F. Pine bark aphis (*Pineus strobi*), a common pest on White Pine, may be successfully combated by the following sprays: (1) Whale-oil soap—1 lb. to 8 gals. of water, (2) home-made oil emulsion, 2 per cent., (3) miscible oils, 1 to 30, (4) lime-sulphur, 32 degrees Baume, 1 to 8. Sprays should be applied with the coarse nozzle and high pressure. The Pine sawflies *Neodiprion lecontei* and *N. abbotti* may be controlled by spraying infested trees with lead arsenate (4 lb. to 100 gals. of water). Lead arsenate acts rather slowly and death does not occur at once.

45.3 : 13.2. WELLENSTEIN, G. Anregungen und Versuche zur Verbesserung der Borkenkäferbekämpfung, I Teil. **[Efforts made to improve bark beetle control, Part I.]** *Z. Forst- u. Jagdw.* 74, 1942 (337–47). [G.] [961].

Results are given of investigations (at present incomplete) carried out in East Prussia on the use of various contact poisons based on cresol and phenol compounds for bark beetle control.

In East Prussia pupae and larvae of the Spruce bark beetle, *Ips typographus*, are seldom found in the winter quarters, since, as a result of low temperatures, the second generation does not emerge in autumn but overwinters in its place of birth. The removal (in unbarked condition) of trees on which the beetles spend the winter is recognized as an effective method of control, but this process must be carried out before the beetles swarm in spring. Infested timber which cannot be removed before 1st April should be left in the forest as a trap, or should be barked on sheets of canvas or other material and the bark buried or burnt.

As control of beetles by the above method makes a high demand on manpower, investigations were made to determine how far the use of insect poisons in the form of dusts or sprays can replace the troublesome and expensive method of barking and burying or burning the bark. Effective control was obtained, even at winter temperatures, by doses of 100 kg. per ha. of Detal dust or a 4 per cent. solution of Borcher's liquid spray, K IV. Although the preliminary tests were made indoors, the technique of control in the field was also developed. Results so far have been encouraging. No great disparity was shown in the effects of the various dusts tested (K III, K IV, Lipan, Novosil, Effusan, Detal), although Detal had the quickest action at high and particularly at low temperatures. All the dusts worked more slowly, but not less effectively, at low temperatures. Slight moisture, such as morning dew, did not have any deleterious effect on the action of the poisons, but heavy downpours of rain could substantially reduce their effectiveness. The amount of poison used should not be less than 50 kg. per ha. By increasing the dose, deaths may be hastened although not increased—an important point in rainy weather.

Liquid sprays have also resulted in a good kill under laboratory conditions, and again low temperature delayed mortality. Better results were obtained by thorough wetting than by slight moistening of affected trees. The stems should be treated immediately after barking, and an area of 2 sq. m. on each side of the stem should also be treated in order to catch beetles which fall down and crawl along the ground. Costs are very high in the case of liquid poisons.

45.3 : 12.25 : 13.2 (43.7). SCHIMITSCHEK, E. Die Massenvermehrung des Kiefernspanners, *Bupalus piniarius* L., und seine Bekämpfung im Jahre 1940 in der Westslowakei. [**The mass outbreak of the Pine looper, *B. piniarius*, and its control in 1940 in western Slovakia.**] *Cbl. gesamte Forstw.* 67, 1941 (25–46, 53–9). [G.] [Institut für Forstentomologie und Forstschutz der Hochschule für Bodenkultur, Vienna.] [962].

An outbreak of *Bupalus piniarius* occurred in 1937–40 in west Slovakia in even-aged stands of *Pinus strobus*, 98 per cent. pure, on land that had previously grown Oak forest. Created mainly for game preservation, these forests were not regularly tended and were for the most part overstocked and unthinned. The 1939–40 looper attack was aggravated by an outbreak of the Pine sawfly, *Diprion pini*, and many trees were killed. Counts made of pupae and eggs of *Bupalus* resulted in the forecast that an incidence of more than 5 healthy pupae per sq. yd. marked the danger limit, and stands with an incidence of 10 pupae per sq. yd. were allotted for immediate control measures. Pupae were less common in the low-lying parts of a stand than in the higher parts; the *Bupalus* population and the number of healthy pupae were greater in the poorer quality stands.

Parasitism varied considerably from place to place; egg parasitism was negligible. Owing to the simultaneous outbreak of *Diprion pini*, its parasites tended to attack *Bupalus piniarius* and vice versa. Dusting was done between 22nd July and 24th August, 1940, with two proprietary insecticides containing dinitro-ortho-cresol, the dosage being about 70 kg. per hectare, chiefly from aeroplanes, but also from mechanical ground equipment. The kill of young *Bupalus* caterpillars was successful, but scorching of shrubs and ground vegetation was rather severe owing to dew and mist being prevalent at the time of dusting. Young Pine needles were badly scorched in zones where the dust fell on wet foliage, and those trees that had been most heavily defoliated in 1939 and had suffered most in the hard winter of 1939–40 showed the worst scorching.

45.3 (73) : 12.25 : 13.2 : 24.3. **Salvage logging: western Pine beetle controlled through forest sanitation.** *Timberman* 46 (6), 1945 (98, 100). [963].

Sanitation-salvage logging is a method of controlling *Dendroctonus* outbreaks by classifying individual standing Pine (*Pinus ponderosa*) according to current health and immediate risk of bark-beetle attack. [Cf. *For. Abstr.* 4 (193).] These high-risk trees show definite symptoms of declining health and form only a small percentage of the stand. Control of *D. brevicornis* by this method has been tried since 1937 in several areas in California, the largest area being 12,000 acres. The costs of operations were 12–25 per cent. higher than in normal logging but in every case allowed a margin of profit, compared with the usual method of control (felling, barking and burning), which costs $3–5 per thousand bd. ft. and gives no return from salvage. All sanitation-salvage projects have been successful in reducing bark-beetle damage by 70–90 per cent. as compared with untreated areas.

45.3 : 12.25 : 13.2 (75–6) : 23.1. HOFFMANN, C. H., and ANDERSON, R. F. **Effect of Southern Pine beetle on timber losses and natural restocking.** *J. For.* 43, 1945 (436–9). [U.S. Bureau of Entomology and Plant Quarantine, Asheville, N.C.] [964].

The southern Pine beetle (*Dendroctonus frontalis* Zimm.) attacks and kills all species of Pine throughout the Southern States. When the insect becomes abundant, which is usually during periods of deficient rainfall, the trees are attacked in groups of from a few to several thousand. A record has been kept of these group 'kills' on 1,122 acres of the Bent Creek watershed (North Carolina) for the last 24 years, and on the 6,440 acres of the whole watershed for the last 9 years in order to determine the timber losses, relative vulnerability to attack of pure and mixed stands, and the natural restocking of the openings formed. It was found that pure Pine stands were more susceptible to attack than the mixed Pine/hardwood stands. On limited areas more than 75 per cent. of Pines 6 in. d.b.h. and over were attacked but smaller trees were less subject to attack. The openings in the stands did not revert to pure Pine but to mixed Pine/hardwoods; little or no Pine reproduction became established, the Pines present in the mixture being those that did not succumb during the attack.

45.3 (77) : 12.25 : 13.2. UNITED STATES. **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 1944.** U.S. Department of Agriculture, Washington, D.C. 1945. pp. 56. [965].

The spittle bug (*Aphrophora saratogensis*), a serious plantation pest in the Lake States, affects thousands of acres of Jack Pine and Red Pine. Damage by this species and by the White Pine weevil, the Pine sawflies, the Pine chafer and the Pine tortoise scale can be prevented by good silvicultural practices (p. 8).

45.3 (83) : 12.25 : 13.2. DURAN, M. Las cuncunas de los pinos, una problema de entomologia forestal. [**The Pine caterpillars, a problem of forest entomology.**] *Agric. téc., Chile* 4 (1), 1944 (17–25). [Span.] [Sección de Zoología Agrícola del Depto. de Sanidad Vegetal.] I.I.E. [966].

The author stresses the need for controlling the ravages of lepidopterous insects such as *Macromphalia dedecora* Feitsch. (Lasiocampidae) and *Dirphia amphimone* (F.) Berg. (Saturnidae) in the Pine forests of Chile, and briefly outlines control measures under the following headings: (1) Direct control by mechanical methods; (2) direct control by biological methods; (3) direct control by chemical methods; and (4) indirect control by chemical methods.

45.3 (71.6) : 13.2. NOVA SCOTIA. **Report of the Department of Lands and Forests, 1944.** King's Printer, Halifax, N.S. 1945. pp. 181 + plates + tbls. [967].

Infestations of European Spruce sawfly (*Gilpinia hercyniae*), hitherto light, have noticeable increased in some areas of Nova Scotia. Arrangements have been made to obtain disease extract [cf. *For. Abstr.* 7 (No. 426)] for liberation in the areas of heaviest population. Numbers of the Spruce gall aphid (*Pineus pinifoliae*) have been further reduced; this insect, which develops on Red Spruce (*Picea rubra*) and White Pine (*Pinus strobus*), has a complicated life history about which little is known owing to its rare occurrence. The injury to Red Spruce, which consists of the formation of galls on the new shoots, is not very serious, but Pine growth is greatly reduced and trees may be killed by the attacks: small Pine up to about 20 ft. high are most affected.

The only occurrence of Spruce budworm *Cacoecia fumiferana*) in the Province in 1944 was on Cape Breton Island. The Balsam woolly aphid (*Adelges piceae*) is present throughout the Province, causing the so-called 'gouty' condition in Balsam Fir (*Abies balsamea*). As much as 35 per cent. of a timber cut is reported to have been refused on account of the 'redwood' caused by this insect. Severe attacks seem to be limited to elevations below about 800 ft.

Little change is reported with regard to the Beech Scale (*Cryptococcus fagi*). Immature trees which were heavily attacked when the infestation was at its height have frequently recovered but are severely cankered. Light to moderate infestations are still evident in many areas on young trees. On several occasions large old-growth Beech were found which apparently exhibited some immunity to attack.

Local infestations of the forest tent caterpillar (*Malacosoma disstria*) occurred throughout the Province. Defoliation varied from 25 to 100 per cent. Hosts noted were Poplar, Grey and White Birch, Maple, Elm, Mountain Ash, Locust, Apple, wild and cultivated Cherry. The fall cankerworm (*Alsophila pometaria*) is generally considered a pest of shade and orchard trees, but has for several years occurred as a forest insect on Red Oak (*Quercus borealis*). It has been associated with an unidentified leaf-roller, and, between the two, defoliation has in some years varied between 60 and 100 per cent. (pp. 35–46).

45.3 (71.6). NOVA SCOTIA. **Report of the Department of Lands and Forests, 1944.** King's Printer, Halifax, N.S. 1945. pp 181 + plates + tbls. [968].

The following species and numbers of insect parasites were obtained in the summer of 1944 for liberation in Nova Scotia.

Parasite	*Host*	*Number liberated*
Chrysocharis laricinellae	Larch case-bearer (*Coleophora laricella*)	8,523
Bassus pumilis	"	836
Exenterus	European Spruce sawfly (*Gilpinia hercyniae*)	650
Sturmia	"	319

In addition 870 nymphs of the praying mantis (*Mantis religiosa*) were liberated. This insect was introduced from Europe as a predator and has become established in some regions of U.S.A. and Canada (p. 55).

45.3 (494) : 13.2. Umfrage an die schweizerischen Forstämter über das Auftreten der gefährlichen Weisstannenlaus (*Dreyfusia nüsslini*). **[Questionnaire to Swiss forest departments on the occurrence of the dangerous Fir chermes (*Dreyfusia nüsslini*).]** *Schweiz. Z. Forstw.* 95, 1944 (415–7). [G.] [969].

In order to obtain a comprehensive picture of the distribution of *Dreyfusia nüsslini* on Silver Fir in Switzerland, the Entomologisches Institut der ETH and the Eidgenössische Anstalt für das forstliche Versuchswesen in Zürich have asked foresters to give particulars of the occurrence of this pest on young trees, and of attacks on the bark of 30- to 100-year-old Silver Firs by *D. nüsslini* or *D. piceae*.

45.3 (71.1) : 12.25 : 13.2 : 07.7. PREBBLE, M. L., and GRAHAM, K. **The current outbreak of defoliating insects in coast Hemlock forests of British Columbia. Part I. Description of outbreak and damage. Part II. Factors of natural control. Part III. Considerations of chemical control.** *B.C. Lumberm.* 29 (2, 3, 4), 1945 (25–7, 42–8; 37–9, 88, 90, 92; 38–9, 60, 62, 64, 118, 120, 122, 124). [Dominion Department of Agriculture, Forest Insect Investigation, Victoria, B.C.] [970].

Defoliation of Hemlock was first observed in 1940 and 1941 and was general by 1943 in southwestern Vancouver Island and parts of Queen Charlotte Islands; in 1944 the attack was very pronounced in northwestern Vancouver Island. Up to that year the blackheaded budworm (*Peronea variana*) had been the most numerous and widespread pest of Western Hemlock and Balsam, but during 1944 a marked increase of three other species, the Hemlock looper (*Ellopia fiscellaria lugubrosa*), the Hemlock sawfly (*Neodiprion tsugae*), and the western rusty tussock moth (*Notholophus antiqua*) was observed, their cycle of increase having started 3 years later than that of the budworm. Each of these pests had previously been destructive in British Columbian coast forests but had subsided for 10 to 15 years.

The present outbreak contradicts the popular conception that epidemics build up at a focal point and spread outwards. It is more probable that an infestation develops from the residual population at several isolated points and that differences in outbreak chronology between districts merely reflect local variations in the factors causing outbreak conditions.

After discussing the damage in heavily infested forests [illustrated by graphs of the annual radial increment of Western and Mountain Hemlocks (*Tsuga heterophylla* and *T. mertensiana*) and Amabilis Fir (*Abies amabilis*) from 1920 onwards] it is concluded that the rise and fall of the defoliator populations in the past resulted solely from natural factors. The factors disadvantageous to residual populations are: (1) weakening of the strain, (2) concentration of natural enemies, and (3) scattering of the population. The natural control of the blackheaded budworm is then analysed in detail by the authors with the conclusion that a polyhedral disease has been the critical controlling factor, and that parasites and predators were less important. There are many natural enemies of the Hemlock pests but there seems to be little chance of using them in a form of biological control. Furthermore there is no precise information available on which to base management practices with the object of developing less susceptible stands. Consequently control must be by the use of chemicals, which is possible only when circumstances of risk and economic values warrant it. The authors conclude with a comprehensive consideration of the policy and practice of chemical control, describing equipment, e.g. power sprayers and dusters, dust bomb mortars, smoke candles, aircraft; insecticides, e.g. smokes and aerosols, arsenicals and other salts, and organic compounds including DN and DDT; factors influencing distribution, retention and effectiveness of insecticides; and costs, which in past trials varied between 2·7 and 15·5 dollars per acre; in general over-all cost per acre decreases as the size of the area to be treated increases.

45.3 : 12.25 : 13.2 (71.3–4) : 13.15. HEIMBURGER, C. C. **Comment on the budworm outbreak in Ontario and Quebec.** *For. Chron.* 21, 1945 (114–26). [Dominion Forest Service, Ottawa, Ont.] [971].

A policy has been evolved to free certain parts of the mixed forest in New Brunswick

and Maine from the budworm (*Cacoecia fumiferana*) by an artificial change in the species composition, preferably by almost completely eliminating Balsam Fir. The writer of this article is convinced that this proposed treatment could not be applied in Eastern Canada, where extensive forms of management are current. He discusses other approaches to the budworm problem, dealing chiefly with the population genetics of the budworm and its parasites, and ecological considerations arising from their interaction with Balsam Fir and other hosts. He considers the Spruce budworm to be biologically 'young' in relation to its macro-environment and therefore to require a long period of adjustment before severe outbreaks are possible; its requirements for sufficient population pressure to cause outbreaks should be very high and its control by its own parasites should be slow. The budworms of other species of Spruce and Pine in other regions are considered to be 'mature' species. After discussing the recent geological history of these host trees he deduces that the new forms of Spruce budworm on Spruce and Tamarack are the result of relatively recent gene combinations, as yet not followed by similar effective production of more efficient parasites, and suggests that it might be possible to find places inhabited by 'mature' budworms with 'mature' parasites. It is parasites of this latter type that should be used in biological control. The value of tolerant hardwood barriers is discussed and their location by biogeographical considerations is thought desirable.

45.3 : 12.25 (79.7) : 13.2. BREAKEY, E. P., GOULD, C. J., and REYNOLDS, C. E. **Seed-corn maggots as pests of coniferous seedlings in Western Washington.** *J. econ. Ent.* 38, 1945 (121). [Agricultural Exp. Sta., State College of Washington.] [972].

A report of damage to seedlings of Spruce and Douglas Fir at the forest nursery of the West Coast Lumbermen's Association at Nisqually, Washington, by the seed-corn maggot, *Hylemyia cilicrura* (Rond.). Fungicidal treatments were ineffective against the maggot, with the exception of chloropicrin and DD (a mixture of dichloroprophylene and dichloropropane). The former gave particularly satisfactory results, reducing the percentage of fatally injured or dead plants from a possible 18·4 per cent. to 7·5 per cent.

45.3 (87) : 12.25–8 : 13.2. BALLOU, C. H. El reconocimiento de insectos en Venezuela. [**Reconnaisance of insects in Venezuela.**] *Bol. Soc. venez. Cienc. nat.* 8, 1943 (147–56). [Span.] I.I.E. [973].

Includes brief notes on damage done to *Swietenia candollei* by *Saissetia oleae*, on defoliation of *Tabebuia pentaphylla* by *Phiditia cuprea*, and on the death of trees of *Thuja orientalis* as a result of attack by *Cinara tujafilina*. Reference is also made to insect pests of numerous other plant species, including *Achras sapota*, *Mimosa bracatinga*, *Parkinsonia aculeata* and *Ficus carica*.

45.3 (71.4) : 12.26–8 : 13.2. LECHEVALIER, H. Un nouvel ennemi pour les saules de Québec. [**A new enemy of Willows in Quebec.**] *Nat. Canad.* 7, 1944 (210). [F.] N.H.M. [974].

Specimens of *Plagiodera versicolora* (Lamk.) were captured in 1942 for the first time in Canada at Belleville, Niagara Falls and La Trappe (Quebec). This European species was first noted in 1911 in the northeastern U.S.A., where it has since caused much damage to Willow and Lombardy Poplar, and is known as the imported Willow leaf beetle.

45.3 : 12.26–8 : 13.2. **Sycamore plant bug.** *Amer. Nurserym.* 81 (8), 1945 (35). [975].

The first symptom of attack by the Sycamore plant bug is the appearance of small red or yellowish spots distributed irregularly over the young leaves. The punctured areas often drop out as the leaf grows, leaving small irregular holes with the margins slightly discoloured. Little is known of the life history of the insect, which has been reported from several areas in the northwestern United States and probably has a much wider distribution.

Control may be obtained by spraying with 40-per-cent. nicotine sulphate in a suitable wetting agent.

45.3 : 13.2 : 23.27 : 42. BROMLEY, S. W. **Control of borers in shade and ornamental trees.** With discussion. *Proc. 20th nat. Shade Tree Conf.* 1944 (105–14). [Bartlett Tree Research Laboratories, Stamford, Conn.] [976].

Following a brief account of some of the outstanding conditions predisposing trees to borer attack, the various methods of control are discussed with reference to the conditions under which each should be applied and the

type of pests for which each is most effective. The methods dealt with are: cutting out (removal of pitch masses and killing of exposed borers), fumigation, wrapping, spraying, feeding (to maintain tree vigour), ether emulsions, cutting and burning.

47. COLLECTIVE INJURIES TO INDIVIDUAL TREE SPECIES

47 : 12.25. HEPTING, G. H., BUCHANAN, T. S., and JACKSON, L. W. R. **Little leaf disease of Pine.** *Circ. U.S. Dep. Agric.* No. 716, 1945. pp 15. [977].

An account of investigations on a disease of *Pinus echinata*, and to a lesser extent of *P. taeda*, the symptoms of which are the formation of fewer and shorter needles resulting from progressive annual shortening of twig growth and ending in premature death of trees of all classes and ages over 20 years. The disease is not directly due to weather, soil moisture, or deficiency in phosphorus and potassium; the many other possible factors are enumerated for further research. Prompt harvesting of affected trees is the only treatment at present indicated.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52.4. *Measurement of Volume*

52.43.2 : 34.6. BARNES, G. H. **Cubic foot scaling and utilization of logging waste.** *Timberman* 46 (6), 1945 (66, 68, 70, 72). [Oregon State College, Corvallis, Ore.] [978].

Attempts to salvage logging waste in the Douglas Fir region of the United States have usually proved unprofitable, partly owing to the low volume given by the log rule used in scaling the salvage material. Most of the board-foot log rules used in the United States underscale all logs relatively to the quantity of timber that is actually sawn from them, but the discrepancy increases as the size of the log decreases. The board-foot log rule was abandoned in 1936 in favour of the cubic foot in Quebec, where large quantities of relatively small-sized pulpwood are used; a similar movement is now on foot in British Columbia. The U.S. Forest Service has already provided for sale of wood products by cubic-foot measure in national forests when it is desired by or acceptable to purchasers. Adoption of the cubic-foot standard would eliminate most of the anomalies of the board foot. It is fully understood in all English-speaking countries and is directly convertible to cubic metres, which are the common basis of measurement in Europe. Three means of scaling in cubic-foot measure are described and discussed, the Huber, Smalian, and Sorensen formulas. The Huber formula, in which the volume is computed by multiplying the cross-sectional area in square feet corresponding to middle diameter, by the length in feet, is best on a theoretical basis and, if middle diameter can be measured without difficulty, is also good on practical grounds, since only one diameter measurement is necessary.

In order to show relative cost reductions on small logs when the log scale bias is removed, figures are given of yarding-to-pond costs for logs of various sizes on board-foot and cubic-foot basis. On the board-foot basis, the cost per thousand feet of logs of 100 board feet is about 7 times that of logs of 2,000 ft. On the cubic-foot basis, the relative cost of the small log is only about 4 times that of the larger.

52.43.3 : 12.26–8 (74.6). MEYER, W. H., and KIENHOLZ, R. **Volume tables for Connecticut hardwoods.** *Bull. Yale Sch. For.* No. 54, 1944. pp. 58. [979].

The data on which these tables are based were collected in the course of salvaging windthrown timber after the hurricane of 1938. There are two sets of tables, one dealing with species in their aggregate, employing both d.b.h. and either total or merchantable height as independent variables, the second eliminating height, and using only diameter and species.

52.43.5 : 64–5 : 22.83. VESTAL, A. G., and HEERMANS, M. F. **Size requirements for reference areas in mixed forest.** *Ecology* 26, 1945 (122–34). [Univ. of Illinois, Urbana.] [980].

This study is an attempt to determine the sizes of areas which are just sufficient to supply certain kinds of information about a stand and about the type of forest vegetation which it may represent. The two old-growth stands studied belong to a highly mixed, mesophytic forest type of prairie-border location. Each stand included about 25 tree species in 50 acres.

Study in frequency of occurrence of combinations of species (from the 12 leading species) fixed upon 0·8 acre as the 'smallest representative area', which gives some idea of stand composition. An aggregate of five 0·8 acre plots further tells the approximate order of abundance among species, and identifies the type. The 4-acre size is thus the 'minimum area for assignment to type'. Twenty acres gives a dependable statement of composition and is called 'definitive area'. A dependable area of diameter distributions, showing form of stand, requires about 80 acres. This area embodies practically all characteristics of a stand, and may be termed 'complete stand'.

56. INCREMENT

56.02 : 11.21 : 12.25. DOUGLASS, A. E. **Survey of *Sequoia* studies.** *Tree-Ring Bull.* 11, 1945 (26–32). [981].

A survey of investigations on the tree-ring chronology of *Sequoia gigantea* carried out in California between 1915 and 1935, with a brief discussion on the relatively sensitive records from Redwood Basin. Early attempts at dating the prehistoric logs of Arizona by the rings of the Giant Sequoias of California were unsuccessful, but a better understanding of the effect of local sites on the formation of tree rings has led to a re-examination of the early data for the purpose of selecting suitable material for the construction of climatic records.

56.02 : 12.26–8 (76.2). BULL, H. **Diameter growth of southern bottomland hardwoods.** *J. For.* 43, 1945 (326–7). [Southern Forest Exp. Sta., New Orleans, La.] [982].

Information on diameter growth of common bottomland hardwoods in mixed stands in the Yazoo-Mississippi Delta region has recently been obtained in connexion with commercial improvement cuttings on the Delta Experimental Forest, Stoneville, Miss. Average d.b.h. growth is given for the following species: Eastern Cottonwood (*Populus deltoides*), Nuttall Oak (*Quercus nuttallii*), Willow Oak (*Quercus phellos*), American Elm (*Ulmus americana*), Honey Locust (*Gleditsia triacanthos*), Red Maple (*Acer rubrum*), Overcup Oak (*Q. lyrata*), Sweetgum (*Liquidambar styraciflua*), Green Ash (*Fraxinus pennsylvanica* var. *lanceolata*), Sugarberry (*Celtis laevigata*), Cedar Elm (*U. crassifolia*), Water Hickory (*Carya aquatica*).

56.04 : 12.25 (79.5 : 79.7) : 57.4 : 57.9. MUNGER, T. T. **Growth records of some permanent sample plots in Douglas Fir and Spruce-Hemlock.** *W. Cst. Lumberm.* 72 (3), 1945 (81, 83–4). [Pacific Northwest Forest and Range Exp. Sta., Portland, Ore.] [983].

About 60 permanent sample plots in immature stands in the Douglas Fir region of Oregon and Washington have been under observation for 5 or more years, some of them for 30 years. Tables are given to show volume, periodic annual growth, and mean annual growth of (1) Spruce/Hemlock, and (2) Douglas Fir plots, based on measurements made in 1935 and 1940. Measurements are given in cubic feet, international board feet and Scribner board feet. The results are in general corroborative of the standard yield tables prepared by the Pacific Northwest Forest and Range Experiment Station from the measurement of a large number of temporary plots.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.1 : 34.21. HUMBERT, J., and DASMANN, W. **Range management—a restatement of definitions and objectives.** *J. For.* 43, 1945 (263–4). [984].

60.3 (71.4) : 97.1 : 94.6. GÉRIN, M. **The needs of forest management in the Province of Quebec.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 761 (A–1), 1945. pp. [2]. [Department of Lands and Forests, Province of Quebec.] [985].

The vital importance of proper forest management in the Province of Quebec is emphasized. It is pointed out that, while such management should be applied at once, it cannot be fully effective until three major pre-management problems are solved: (1) Land classification—the definite delimitation of agricultural and forest soils is necessary to assure stability of tenure. (2) Re-allocation of timber limits—the actual distribution of forest holdings amongst the various forest industries should be readjusted and re-made on a more suitable basis. (3) Forest finance—the reorganization of the forest industry should be made on the basis of sustained-yield management in contrast to the present policy of early liquidation.

61. SURVEYING. MAPPING

61.32 : 52.43.5. STANDISH, M. **The use of aerial photographs in forestry.** *J. For.* 43, 1945 (252–7). [986].

Following a brief general account of the use of air photographs in North American forestry, with reference to type and scale of photographs, stereoscopy, and the influence of seasonal variation, a more detailed account is given of the use of air photographs in determining timber volume. For this purpose a $\frac{1}{5}$-acre circular sample plot has been found to be most convenient; on the photographs this plot must be converted to a circle at the same scale as that of the photographs. It is suggested that the best method of doing this is to draw circles in black india ink on white paper at two or three times the desired diameter, then photograph the circles which can be printed on a glass plate at the exact scale wanted. The plate can then be placed over the photograph and the trees counted.

A scale for measuring tree shadows in thousandths of an inch is constructed in the same manner except that the material used should be a flexible film. A simple scale may be made by drawing a right-angled triangle with a base of 5 in. and a height of 0·1 in.; the base should be graduated into inches and twentieths of an inch. The tree shadow is measured between the hypotenuse and base of the triangle. It is necessary to measure the tree shadow on the horizontal; if the tree is on a slope the shadow selected should be along the same contour as the base of the tree. It is necessary to know the date, latitude and longitude within one degree, and the exact time of the photographic exposure in order to calculate tree heights from shadow measurements. A set of graphs computed for each month, day and hour may be constructed to give a converting factor for each shadow length.

Volume tables used in aerial surveys should be based on height rather than on diameter, and must be made for various types of growth, such as old-growth hardwoods, second-growth hardwoods, softwoods, etc. These tables are made for each 5-ft. height class, but for areas of sawlog or old-growth stands, these should be sub-divided into 2½-ft. classes. Old-growth, large-crowned trees tend to increase in diameter at a faster rate than in height; consequently an old-growth tree with a total height of 80 ft. may vary from 18 in. to 36 in. in diameter. Wherever possible, old-growth areas should be delineated beforehand and special tables applied to them. After the volume tables are completed, the sampling circles and shadow scale obtained, and the shadow-conversion curves plotted, all that remains to complete the estimate is to count the tree crowns within the circle, determine the average shadow length, convert it to tree height, apply the given volume and multiply it by the number of trees.

61.4 (79.4). LYMAN, C. K. **Foresters as topographic mappers in the Redwoods.** *J. For.* 43, 1945 (265–8). [Northern Rocky Mountain Forest and Range Exp. Sta., Missoula, Mont.] [987].

The U.S. Forest Service carried out for the War Department the mapping of the coastal area of northern California. The high standard demanded, the presence of the giant Redwoods, and the foggy climate combined to make the task a difficult one. It was carried out by a combination of ground and aerial survey; an account is given of some of the difficulties met with and the methods by which they were overcome.

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

64 : 12.25 (79.4) : 22.83. DUNNING, D. **A site classification for the mixed-conifer selection forests of the Sierra Nevada.** *Res. Note Calif. For. and Range Exp. Sta.* No. 28, 1942. pp. 21. [988].

Site classification curves are presented for the mixed conifer selection forests of the California Pine region. The classification is based on the height-age relation for dominant trees of one or more of the four species Ponderosa Pine (*Pinus ponderosa*), Sugar Pine (*Pinus lambertiana*), Douglas Fir (*Pseudotsuga taxifolia*) and Silver Fir (*Abies venusta*).

67. PERIODIC AND ANNUAL WORKING PLANS

67. **Outline for a working plan.** *Silvic. Leafl. Dom. For. Serv.* No. 21, 1945. pp. 2. [989].

A modification, to meet the requirements of pulpwood operations, of an outline for a working plan published by A. B. Recknagel in 1917.

9. FOREST POLICY

9 (410). GREAT BRITAIN. **Post-war forestry. A report on forestry policy prepared by the Royal Scottish Forestry Society and the Royal English Forestry Society.** Royal Scottish Forestry Society, 8 Rutland Square, Edinburgh 1. Royal English Forestry Society, 48 Dover St., London, W.1. 1944. pp. 62. [990].

This report, which has been prepared by the Royal Scottish and Royal English Forestry Societies, deals with the problems of private forestry and the means by which owners should be encouraged and assisted to make their woodlands more productive. The following are the principal recommendations of the report.

The Forestry Commission should be replaced by a new Forest Authority consisting of a Board appointed by and responsible to a Minister; all technical officers should be responsible to this Board. The technical members of the Board who are in charge of departments dealing with estate woodlands should have separate staffs from those dealing with national forests. A series of regional conservators and forestry committees should be instituted to deal with estate woodlands.

The report supports the Forestry Commissioners' scheme for the dedication of estate woodlands, but considers that compulsory acquisition as a penalty for failure to dedicate should not be applied until such time as the Forest Authority shall have provided assistance in the form of advice, education, co-operative societies, etc. A determined effort should be made to include 'small woods' (whose total area is estimated at one million acres) in the dedication scheme, and the Forest Authority should be prepared to acquire 'small woods' if necessary, to prevent their falling into decay.

Felling licences are a necessary safeguard against over-felling in undedicated woodlands. Felling in dedicated woodlands should not be subject to licence, since they will be managed under plans approved by the Forest Authority.

The Societies recommend financial assistance in the form of grants for planting and maintenance on rather more favourable terms than those advanced in the Forestry Commissioners' Supplementary Report [cf. *For. Abstr.* 6 (54)]. In addition they consider that there should be a grant for clearing scrub and the debris of war fellings. Loans should be made available at a low rate of interest.

The present prices for some categories of standing timber are uneconomic. Prices should either be decontrolled, or some of the maximum prices should be materially raised. It is essential that the Forest Authority, being the largest woodland owner in Britain, should co-operate with private owners in marketing and in fixing standard prices for woodland products.

An earnest endeavour should be made to recruit into the forestry profession a large number of able men with appropriate qualifications. More regular rates of pay should be established for forestry workers on private estates. It will be necessary immediately after the war to train not fewer than 2,000 head foresters and forest foremen, and thereafter 300 to 500 men a year will be required. It is recommended that the nucleus of an educational department of the Forest Authority should be established at an early date, and interim training centres proceeded with. The educational structure should include demonstration forests, demonstration estates for local instruction, courses for woodmen at approved centres, and the production of a 'forest sense' in the public.

The Societies consider that the allocation of £30,000 a year for research, as recommended by the Forestry Commission, is inadequate. They would view with satisfaction the allocation of as much as £150,000 a year by the end of the first ten-year period. In addition to silviculture, ecology, and protection, there should be research on the economics of forestry practice, woodland administration, forest engineering, selection of seed, and improvement of tree species, estate maintenance and the utilization and marketing of woodland products.

It is recommended that the Ministry of Agriculture and the Forest Authority should collaborate in setting up an adequately financed joint authority for the extermination of rabbits.

9 (410). **Forestry Policy (Departmental Responsibility): Sir John Anderson's Statement [Col. 403].** *Parliamentary Debates* (*Hansard*): *House of Commons Official Report* 408, 1945 (404–5). **Motion — Post-war Forestry.** *Parliamentary Debates* (*Hansard*):

House of Lords Official Report (*unrevised*) 135, 1945 (18–66). [991].

Sir John Anderson on 15 Feb. 1945 made a statement in the House of Commons, announcing the intention of the Government to enlarge the sphere of the Minister of Agriculture and Fisheries and the Secretary of State for Scotland, so that these Ministers may become jointly responsible for forestry policy and for supervising the measures for its execution. Under such an arrangement the Forestry Commission will be retained as a single continuing expert body, responsible directly to Ministers for advice on forestry policy and for carrying out operations, including training, research and forest holding. The Commissioners will, as at present, be appointed by the Crown.

The debate in the House of Lords took place on 20 Feb. 1945 on a motion by Lord Bingley.

90. GENERAL PRINCIPLES OF FOREST POLICY

90 (71.5). **Forestry and post-war reconstruction in New Brunswick.** New Brunswick Forest Production Association and New Brunswick Section, Canadian Forestry Association. 1944. pp. 40. [992].

This brief was prepared jointly by the New Brunswick Forest Products Association and the New Brunswick Section, Canadian Forestry Association, for presentation to the New Brunswick Committee on Reconstruction in January 1944. In preliminary form it had been approved by the New Brunswick Association of Registered Foresters and the Maritime Section of the Canadian Society of Forest Engineers.

Part I deals with the general problem of reconstruction in forestry in New Brunswick, firstly by setting forth critically the present conditions that need attention and correction, and secondly by recommending the steps to be taken for the proper development of the forest resources. These recommendations are as follows:—

1. An organization to be set up on a permanent basis to gather information on the forest resources, uses of wood, and potential markets, and to promote the development of industrial enterprises suited to conditions in New Brunswick.

2. The University of New Brunswick to establish a school for technical instruction of men for forest services and forest industries. This must be done in time to provide key men for post-war projects.

3. The University to develop an adequate extension service.

4. The Provincial Forest Authority, as a Department, or preferably as a Commission, to be expanded to undertake efficiently the following duties:—

(*a*) Protection of all forests.
(*b*) Management of crown lands and control of cutting.
(*c*) Building and maintenance of an adequate system of forest roads.
(*d*) Making necessary surveys, maps and aerial photographs.
(*e*) Management of game and fish and development of forest recreation.
(*f*) Investigation of the economics of forest production, taxation, etc.

Part 2 of the brief is concerned with a number of specific reconstruction projects, the purposes, costs and rehabilitation value of which are briefly discussed. The following is a list of the projects proposed with estimates of the labour and cost involved:—

Project	*Estimated man days*	*Estimated expenditure*
Aerial Photographs—First complete series if not provided by Dominion	—	$300,000
Forest Motor Roads	600,000	8,000,000
Construction for Forest Fire Protection	75,000	750,000
Forest Inventory	75,000	450,000
Control and Boundary Surveys	75,000	450,000
Forest Authority Building (Estimate not included. Considered Public Works Project)		
Ranger School Building	10,000	100,000
Demonstration Forests	15,000	100,000
Game Management and Recreation Facilities	200,000	1,000,000
Forest Nurseries	20,000	100,000
Roadside Improvement	50,000	250,000
Total	1,120,000	$11,500,000

90 : 60.3 (71.5). PRINCE, G. H. **Planning for forest management.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 762 (A–1), 1945. pp. [2]. [Department of Lands and Mines, Province of New Brunswick.] [993].

The importance of the forests of New Brunswick in the economy of that province is emphasized—they yield a larger proportion of total production than in any other province in Canada—and the problems of forest management are discussed briefly with particular reference to products, markets and ownership. Plans and progress related to forest management in New Brunswick are outlined [cf. preceding abstract].

90 (71.5) : 07.1 : 91.8. GIBSON, J. M. **Whither forestry.** *Timber of Canada* 5 (9), 1944–45 (31–4, 62, 64, 66, 68). [Forestry Department, Univ. of New Brunswick, Fredericton, N.B.] [994].

The writer reviews briefly the history of forestry in Canada, particularly the development of forest education, and discusses the present position and future possibilities of forestry in that country. The proposals of the New Brunswick Forest Products Association and the New Brunswick Section, Canadian Forestry Association for post-war development are given.

90 (729.5). **A newly stated public forest land policy for Puerto Rico.** *Carib. For.* 6, 1944–45 (171–89). [E.Span.F.] [995].

A new directive addressed to the Chief of the Insular Forest Service, Puerto Rico, by the Commissioner of Agriculture is given in full. It deals with the activities of the Service in connexion with the state-owned forests (Insular Forests) and lays down lines of general forest policy. Briefly the objects of management are to return to the people the greatest social benefits including maximum opportunities for local employment.

90 (729.9) : 86. **Forestry in the Leeward Islands: the British Virgin Islands. Report by the Conservator of Forest, Trinidad and Tobago, after preliminary visit by J. S. Beard, Assistant Conservator.** *Bull. Devel. Welfare W. Indies* No. 7A, 1945. pp. [i] + 16 + map. [996].

A report on the British Virgin Islands based on observations made during a visit to the islands by the Assistant Conservator of Forests, West Indies. There are 3 main sections, a general description of the islands with a more detailed description of the forests, a statement of general forest policy, and detailed recommendations for implementing that policy. An appendix gives a list of local and scientific names of trees and shrubs mentioned in the report.

91. SOCIAL AND ECONOMIC SIGNIFICANCE OF THE FOREST

91.4. El bosque y sus influencias sobre la salubridad. [**The forest and its influence on health conditions.**] *Rev. agric., Guatemala* Jan. 1945 (159–61). [Span.] E.M.B. [997].

A general discussion of the influence of the forest on conditions affecting health. Reference is made to the enormous quantity of oxygen produced by trees, the adverse effect of the drying up of swamps (due to tree planting) on the spread of malaria-bearing mosquitoes, the 'filtering' action of trees, which reduces the number and virulence of disease-carrying bacteria in forested areas, and the beneficial effect of trees in the cure of tuberculosis and other pulmonary diseases.

91.4 : 23.3 : 23.21. HOPKINS, G. H. E. **Modern methods for the control of mosquitoes and malaria.** *E. Afr. agric. J.* 7, 1941–42 (212–9); 8, 1942–43 (42–6). [998].

In East Africa, where large permanent swamps are an important problem in malaria control and the malaria vectors (*Anopheles gambiae* and *A. funestus*) prefer or at least will tolerate unshaded water, afforestation can be an effective control measure both in drying the swamp areas and in providing shade.

The advantages claimed for this method over simple drainage are: (1) more rapid drying of swamps, (2) provision of heavy shade will stop the breeding of malaria vectors, and (3) afforestation pays for itself eventually and may even show a profit. The first essential is to select a species which will grow well in very wet conditions. *Eucalyptus robusta* is the species found most generally suitable in Uganda swamps. Along such ditches as are likely to be permanent, the aim must be to produce shade so heavy as to inhibit the breeding of malaria vectors, and for this purpose Eucalypts are unsuitable as they do not produce heavy shade. Mango is moderately suitable but it is possible that indigenous species of *Ficus* would be much better; some of them

are quick-growing and can be propagated from quite large branches by layering. *Tithonia diversifolia*, a shrub known as Mexican Marigold, has been much used in Java to shade ditches and narrow streams and has also been successfully employed in Tanganyika. It grows rapidly and forms very dense shade. It is necessary to plant young trees on mounds of mud so as to bring them above the surface of the water, and a temporary drawback is that the trenches from which the mud is obtained become exceptionally effective breeding centres for *A. gambiae* until the growth of trees and drying up of the swamp render them harmless. The cheapest and simplest method of dealing with these trenches is to fill them with cut green vegetation, the decay of which effectually inhibits breeding. Oil must not be used, as it would kill the young trees.

91.5 (71.4). FRANCIS, S. H. **Notes on forest settlements on leased crown lands in the Province of Quebec.** *For. Chron.* 21, 1945 (109–13). [Quebec North Shore Paper Company, Comeau Bay, Quebec.] [999].

A number of forest settlements have been established in Quebec in the past 10 years, mostly planned by Government and designed to augment the income derived from farms on marginal lands, the production of wood being subsidiary to the main business of agriculture. A new plan has now been formulated by the Quebec Government in collaboration with some of the larger pulpwood companies for the establishment of a true forest colony that will derive its income almost entirely from the forest. A brief account is given of the proposed settlements, its administration and organization, the benefits to be derived therefrom, and the responsibilities of government and the companies in connexion with its establishment.

92. FOREST LAW

92 (410). GREAT BRITAIN. **Forestry Bill: Motion for second reading—[Mr. Hudson]. Amendment—[Mr. Price]—after debate, by leave, withdrawn. Bill read a second time.** *Parliamentary Debates* (*Hansard*) 410, 1945 (1739–1810). **Forestry (Money): Considered in Committee.** *Parliamentary Debates* (*Hansard*) 410, 1945 (1810–11). **Forestry (Money): Resolution reported, and agreed to.** *Parliamentary Debates* (*Hansard*) 410, 1945 (2147–8). **[1000].**

The second reading of the Forestry Bill was moved by the Minister of Agriculture on 4th May, 1945, and agreed to after debate, and the Bill was accordingly committed to a Standing Committee. The Bill leaves the Forestry Commission as the single statutory body responsible for all forestry operations in England, Scotland and Wales, but makes it responsible to the Minister of Agriculture and the Secretary of State for Scotland jointly. The Commissioners are to appoint national committees for England, Scotland and Wales, to consist partly of the Commissioners themselves, partly of their officers, and partly of co-opted members. All future purchases of land will be made by the two Ministers, and all land at present in the possession of the Commissioners will be transferred, in Scotland to the Secretary of State, and in England and Wales to the Minister of Agriculture. The necessary financial readjustments are provided in a resolution agreed to on 10th May, 1945.

92 (73) : 97.1. **An act to amend the conservation law, in relation to the cooperative formulation and application of forest practice standards.** State of New York in Assembly, February 26, 1945. pp. 5. [1001].

94. FOREST OWNERSHIP

94.11 (73) : 60.31.1 : 90 : 91 : 92 : 07.2. **The work of the U.S. Forest Service.** *Misc. Publ. U.S. Dep. Agric.* No. 290, (revised) 1945. pp. 32. [1002].

There are at present 158 national forests in the United States, covering an area of 178 million acres. They are for the most part situated in mountain regions, and those in continental U.S.A. contain nearly one-sixth of the forest land suitable for growing trees for commercial use. Timber and other forest products are the chief crops on about half of the natural forest land, while most of the rest is managed for grazing and water conservation. This bulletin gives a brief account of the acquisition of national forest land and the principles of forest administration, the management of timber, range and water resources, fire, insect and disease control, and co-operation with states and private owners in management of private forests, farm woodlots, community forests and shelterbelt projects. Some account is also given of the research activities of the U.S. Forest Service.

95. FOREST TAXATION. LOANS AND INSURANCE

95 (494) : 72. BAVIER, B. Die Bedeutung von Ausgleichsbeiträgen für die Nutzung von Schlägen in entlegenen Gebirgswaldungen und deren Ueberführung in die Nachkriegszeit, als Massnahme der Bergbauernhilfe. [**The significance of compensation payments for the use of felling areas in outlying mountain forests, and their carrying over in the post-war period, as a measure of assistance to mountain farmers.**] *Schweiz. Z. Forstw.* 95, 1944 (404–10). [G.] [1003].

During the war period, the disproportion between production costs and controlled maximum prices combined with sharply rising wages was particularly marked in the Canton of Graubünden and subsidies had to be given to enable fellings to be made in outlying areas; in particular, a guaranteed profit for firewood. Although measures of this type are useful in time of war or in the transition period between war and peace, it is not advisable that they should be carried over into the post-war period. If a net profit is assured for fellings in outlying and so far unexploited mountain forests, the forest owner will have little incentive to improve the technique of exploitation or to build forest roads at comparatively high cost to himself, and there is danger that forest management will remain at the level of mere timber exploitation to the detriment of silviculture. Costs of production would remain high without a corresponding improvement in working methods. A great increase in the building of forest roads is desirable as a permanent measure for increasing the intensity of forest management.

96. POLICY REGARDING PROTECTION FOREST AND DEFORESTATION

96.3 (77.5) : 92 : 60.31.2 WILSON, F. G. **To put an end to unrestrained cutting.** *J. For.* 43, 1945 (258–62). [Wisconsin Conservation Department, Madison, Wis.] [1004].

The author of this article explains the principles which he thinks should govern legislation restricting the right to cut trees on privately owned lands and gives a draft of proposed legislation to suit Wisconsin conditions.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

97.1 (67.8) : 34.21. STAPLES, R. R. **Bush control and deferred grazing as measures to improve pastures.** *E. Afr. agric. J.* 10, 1945 (217–22 + plates); 11, 1945 (43–6). [1005].

A description is given of a simple enclosure grazing experiment at Mpwapwa, started at the end of 1937, and designed to obtain information on the effect of the control of woody growth (shrubs and trees) on the carrying capacity and quality of pastures under Mpwapwa conditions and the system of deferred grazing which should be encouraged in these areas.

Pastures in which woody vegetation was cleared and burned, and woody regeneration weeded out, increased greatly in carrying capacity and gave a more satisfactory distribution of feed throughout the year. Grassland pastures, even when the herbage is mainly of annual species, can be grazed at intensities of from 3 to 1½ acres per beast either on a yearly or a deferred basis, and yet apparently give satisfactory protection against erosion and run-off. Secondary bushland pastures grazed on a deferred basis, even at the low intensity of a beast to 14 acres, showed obvious signs of run-off and sheet erosion, with the ground largely bare and devoid of feed by the end of the dry season.

The system of deferred grazing, in which the pasture is not grazed during the second half of the growing season (March to June) has given excellent results on grassland in increasing carrying capacity and both quality and quantity of feed available for dry season use. This treatment also appears to have encouraged the growth of perennial grasses most. Deferred grazing of secondary bushland, on the other hand, has not encouraged the growth of perennial grasses in any way.

In the writer's opinion far too little attention has been paid to the economic developments of the livestock industry in the semi-arid areas of East Africa, the basis of which should be the improvement of the pastures. The results obtained from this experiment indicate clearly the lines on which this could be tackled. *From author's summary.*

97.1 (97). LIVERSAGE, V. **Land tenure in the Colonies.** Cambridge University Press. 1945. pp. ix + 151. Price 7*s.* 6*d.* [1006].

The book begins with a brief account of different systems of land tenure, and the supersession of customary by contractual tenures. Owner occupation is usually regarded as the highest and most desirable form of land-owning for agricultural areas, but has very serious defects, which are examined in some detail; these include: (*a*) speculation in land values; (*b*) the sinking of too much capital in purchase of land with consequent lack of capital for agricultural development; (*c*) fluctuation of values and profits, and consequent indebtedness. Chapters deal respectively with dangers in the freehold system, subdivision and fragmentation, the extent and consequence of farm indebtedness, and the weaknesses of owner-occupation. Some attempted remedies are described, including the Egyptian Five-Feddan Law and the Punjab Alienation of Land Act, which were designed to combat the worst evil of peasant proprietorship, heavy indebtedness. Other remedies which have been tried are co-operatives and credit societies. The last of these was successful in India during the prosperous 'twenties', but its long-term result has probably been to increase indebtedness.

The conclusion reached is that the only practical approach to the problem is through the tenure system itself. A sound system of land tenure must be such as will lead to the best and most economic use of the land. Two chapters on modern policy review various systems of tenure in different parts of the world. For colonial countries the writer concludes that the best solution is probably for the government to buy out existing claims to land and thus convert free landowners into secure tenants subject to official control of land use.

97.2 (73) : 94.4 : 98.1. KELLER, J. W. **Farm forestry projects in time of war.** *Soil Conserv.* 10, 1945 (221–4). [Soil Conservation Service, Washington, D.C.] [1007].

A summary of the activities of farm foresters and co-operative farm forestry organizations in the United States in recent years. During the fiscal year 1944, the Soil Conservation Service was responsible for 46 farm forestry projects in 32 states. Sixteen of these projects were administered by State Foresters while the remaining 30 were administered by the Soil Conservation Service. The cost of administering a farm forestry project (including both Federal and State funds) varied from $3,200 to $4,427. Two types of co-operators were assisted by farm foresters: (1) those interested in managing their woodlands as producing units of their farms, and (2) those concerned chiefly with methods of cutting and marketing. The most important activity of farm foresters during the year was assisting in the production of wood products for furthering the war effort. The principal products removed were logs, poles and piling, cross-ties, pulpwood, fence posts and fuelwood.

98. THE TIMBER MARKET

98.1 (410) : 09.4 : 82. **Timber played its part.** *Timb. Tr. J.* 173, 1945 (239–46). [1008].

An account of the work of the Timber Control Department in Great Britain and the production of timber there during the war. The following table shows production from September 1939 to December 1943, in cu. ft.

	England and Wales	*Scotland*	*N. Ireland*	*Total*
Sawn hardwoods	147,000,000	10,000,000	1,900,000	158,900,000
Sawn softwoods	94,000,000	90,000,000	3,900,000	187,900,000
Sawn mining timber	30,000,000	42,000,000	—	72,000,000
Round mining timber	141,000,000	68,000,000	1,400,000	210,400,000
Totals	412,000,000	210,000,000	7,200,000	629,200,000

These figures do not include large quantities of telegraph and obstruction poles, timber for wood-wool, pulpwood, charcoal, cordwood and firewood, nor 4,360,000 railway sleepers.

An account is given of the provision of labour to make this production possible, including Canadian, Australian and New Zealand military forestry units and the Women's Timber Corps.

98.1 (68.9) : 09.4. **Timber in Southern Rhodesia.** *Wood* 10, 1945 (133). [1009].

In 1942–43 Southern Rhodesia exported 1,500,000 cu. ft. of timber (Gum and Pine poles) for the Allied war effort and more in 1944. The country consumed about a million

cu. ft. of softwood annually before the war; now 7,000,000 cu. ft are needed, which will entail an increase in land under forest from 10,000 to 50,000 acres. The yield of this area would be used only to supply local requirements and not for competition in the world softwood market.

98.1 (729.5) : 09.4 : 32–3. TEESDALE, L. V., and GIRARD, J. W. **Wood utilization in Puerto Rico.** [*Publ.*] *U.S. For. Serv.* No. TP21, 1945. pp. 46 + plates. P.R. [1010].

Results of a reconnaissance of the forest resources of the main island of Puerto Rico made by the Puerto Rico Development Company chiefly to determine the possibility of expanding the local production of furniture. The data collected on forest area, volume, rate of growth, consumption, and on logging methods and cost, show that the Puerto Rico forests contain only a small amount of merchantable timber suited for furniture and that the trees are scattered through rough country where extraction costs are high. Out of a total land area of 2 million acres, about 600,000 acres carry tree growth; the present wood volume down to the minimum size utilized (½-in. diameter or less) is about 15,300,000 cords and the increment about 806,000 cords; the annual drain (almost entirely for fuel) is 30 per cent. greater than the growth. Local furniture woods such as *Guarea trichilioides*, *Cedrela odorata*, *Magnolia splendens* and *M. portoricensis* form only a small percentage of the total sawlog volume of 300,000 cords.

In considering the present and future timber requirements the report discusses all aspects of utilization and covers in greater detail the development of the wood-working and milling industries. It is the function of the Puerto Rico Development Company to promote such development, which it proposes to do by setting up a central supply and distribution yard with sawmill, seasoning kilns and sheds (at a cost of $152,000), and organizing co-operative buying through a central purchasing agency. To supplement local supplies, imports of timber from the Dominican Republic, Haiti and other sources are desirable; possibilities are discussed in appendices.

Appendices to this report are:—A. Seasoning problems in Puerto Rico. B. Timber supply in the Dominican Republic and Haiti. C. Review of the termite problem. D. Dimension stock. There is a selected bibliography of 13 references.

98.1 (75.2–6 : 76.8–9) : 09.4. TODD, A. S., jun. **Wartime lumber production in the Appalachian hardwood region.** *For. Surv. Release Appal. For. Exp. Sta.* No. 16, 1944. pp. 54. [U.S. Forest Service.] P.R. [1011].

A comprehensive progress report, covering the period from January 1942 to June 1944, dealing with the production and disposal of lumber, together with a discussion of the factors which affected lumber production at this stage of the war. Plates showing areas of production of various hardwoods are appended.

98.1 (941) : 12.26–8 : 31.4 : 60.31.1. NUNN, F. **Giants of the western forests of Australia.** *Wood* 10, 1945 (167–9). [1012].

A general account of the Karri (*Eucalyptus diversicolor*) and Jarrah (*E. marginata*) forests in Western Australia. The average height of the Karri is 200 ft. with d.b.h. 8 to 10 ft. and a clear log length of up to 120 ft., with stem volumes of up to 7,500 cu. ft. of timber and yields per acre of over 90,000 super ft. of log timber. The State forests cover nearly 3½ million acres of which the pure Karri stands occupy only some 150,000 acres. The rest is mainly covered by Jarrah, the average height of which is 150 ft. with d.b.h. about 5 ft. and a clear log length of 40 to 60 ft. In virgin Jarrah forest the volume of mature timber suitable for the mill, measured in the round is 5,000 to 6,000 cu. ft. per acre. Jarrah timber is of exceptional durability: piles and posts used in bridges and buildings have been found to be quite sound after 50 or 70 years, and Jarrah sleepers in perfect condition when the rails laid on them are quite worn out.

The aim of management of the State Forests is to cut only the annual increment, but it will be some years before this is possible. Sawmilling rights have been granted over large areas, but marking is done by State foresters. There has always been a regulation forbidding the cutting of Jarrah under 90 in. g.b.h. and Karri under 108 in. A normal year's cut of log timber from State Forests amounts to about 38,378,000 cu. ft., from which about 12 million cu. ft. of sawn and hewn timber is produced. Jarrah accounts for about three-fifths of the total.

98.1 (946). LEITCH, G. B. **Tasmanian timber supplies.** *Aust. Timb. J.* 11, 1945 (113, 127). [1013].

Tasmania has always had to export from 75 to 80 per cent. of its timber production to the mainland of Australia, as the local trade could absorb only 20 to 25 per cent. of it. Arrangements are now being made by the Timber Controller and the local Timber Associations to ensure that enough constructional timber is set aside to meet local post-war building requirements.

98.2 (485) : 33.3. SWEDEN. **Review of commercial conditions.** H.M. Stationery Office, York House, Kingsway, London, W.C.2. Feb. 1945. pp. 32. O.R.E. [1014].

This review includes brief references to the Swedish timber industry, which before the war formed the basis of a very important export trade in timber, wooden products and various wood derivatives. During the war years the timber industry was called upon to supply large quantities of wood for home consumption as domestic fuel, fuel for producer gas engines, charcoal and numerous by-products. About 870,000 tons of fodder cellulose were produced during the early part of the war (up to 1943), and cellulose is being used to manufacture 'forbolin', a substitute for linoleum. In addition to its use in the domestic textile industry, cellulose is being exported in large quantities for the manufacture of rayon. A yeast-albumen substance has been produced by the Svartik sulphite mill as a substitute for meat, and a new type of plywood impervious to water has been invented. The manufacture of standard wooden houses is being extended to meet the expected post-war demand in countries affected by the war.

FORESTRY THE WORLD OVER

References: 1. *American Nurseryman*, Chicago. 2. *Australian Timber Journal*, Sydney. 3. *British Columbia Lumberman*, Vancouver, B.C. 4. *Canadian Geographical Journal*, Montreal. 5. *Chemical Engineering News*, Washington. 6. *Chemical Trade Journal*, London. 7. *Crown Colonist*, London. 8. *Foreign Commerce Weekly*, Washington. 9. *Forest Insect Investigations Bi-monthly Progress Report*, Ottawa. 10. *Forest Leaves*, Philadelphia. 11. *Jamaica, Annual Report of the Government Entomologist.* 12. *Journal of Forestry*, Washington. 13. *Pacific Pulp and Paper Industry*, Seattle, Wash. 14. *Timber Trade Journal*, London. 15. *Timberman*, Portland, Ore. 16. *The Times*, London. 17. *West Coast Lumberman*, Seattle, Wash. 18. *Wood*, London. The numbers in brackets indicate the reference number and the date of the publication of the newspapers or periodicals to which the annotations refer.

Australia. On the basis of present plantings, it is believed that in 15 years' time South Australia will be the largest timber-producing state in the Commonwealth. About 3,000 acres of Pine have been planted annually for the last 20 years, and there is now a total of some 100,000 acres of plantations. The aim of the State Government is to maintain 120,000 acres of *Pinus radiata* on a 40-year rotation, thus providing 3,000 acres of each age class from 1 to 40 years. All electric power for the numerous sawmills and for the village of Mount Burr, where the forest research station is situated, is developed by burning wood waste which is fed into large furnaces by conveyor belts (2; May 1945).

Brazil. The timber industry of Southern Brazil (Santa Catarina and Rio Grande do Sul) has tended to over-expansion, despite the fact that the domestic as well as the foreign demand (from Argentina and South Africa) for its products has increased. A number of wood-pulp mills have also been established, but it is doubtful whether they will be able to meet post-war competition. The Instituto do Pinho has therefore ordered a drastic reduction in authorized production of timber for 1944 and 1945 (8; 30.4.45).

The State of São Paulo, Brazil, has 697 registered sawmills with a total annual production of about 400,000 cu. m. of hardwoods, 23,000 cu. m. of Pine, and 70,000 cu. m. of mixed woods. The adjacent State of Parana has an annual output of about 1,200,000 cu. m. of Parana Pine (*Araucaria brasiliana*), which is the timber of greatest economic value because of its dense stands, ease of extraction, and many uses; it occurs over wide areas but is most plentiful in the State of Parana. Peroba (*Tecoma peroba*) is much used in construction (8; 1.8.45).

As a result of research carried out by the rubber laboratory of the Instituto Agronómico do Norte near Belem in the State of Para, a rubber tree has been developed that will give a greater yield of

latex than is obtained from wild trees, and is resistant to the leaf disease which in the past has proved a handicap to the development of commercial rubber plantations in the Amazon Valley. The new tree is produced by grafting a bud from a high latex-yielding tree on to a strong root system of another tree. Later, after this bud has developed into the trunk, a third strain, which is not susceptible to the leaf disease, is added by top-budding at a height of 6 or 7 ft. from the ground to form a new crown. It is expected that the Brazilian Government will soon begin a programme of planting and cultivating these trees in various parts of the Amazon Valley (**3**; 7.7.45).

British Guiana. The record timber production in British Guiana before the war was 1,058,000 cu. ft. in 1938. In 1941 it rose to 1,665,000 cu. ft. and in 1942 to 1,695,000 cu. ft. There was a drop of 6,000 cu. ft. in 1943. The figures for the most important species in 1943 were 889,000 cu. ft. of Greenheart (*Nectandra rodioei*), used largely for heavy constructional work; 512,000 cu. ft. of Crabwood (*Carapa guianensis*); and 279,000 cu. ft. of Mora (*Mora excelsa*). A large sawmill is being erected, and it is expected that the post-war demand for British Guiana timbers will be sufficiently great to keep the expanded industry running full-time for some years (**7**; June, 1945).

Canada. The northern forests of British Columbia are to be patrolled from the air during the period June 15th to October 15th in an effort to reduce fire losses. The Minister of Lands has signed a contract with Canadian Pacific Airlines to supply the aircraft. A Fairchild *Travelair* stationed at Prince George will be used for reconnaissance and patrol work, and a *Norseman* stationed at Fort St. James for transporting aerial fire parties and parachuting supplies to fire crews in action. In 1944 three-quarters of the provincial fire loss was in the Prince George District, which covers most of the northern area. Daily patrols will be maintained over the danger areas, weather permitting. Mobile suppression crews composed of high-school boys will also play an important part in B.C. fire-fighting this year. Sixteen crews of 8 boys each will be in the bush for the summer (**15**; July, 1945).

The establishment of an Office of Public Relations and Education in the Forest Service of British Columbia is announced by the Minister of Lands and Forests, Victoria. The new office will take charge of the Forest Service library and photographs. Its function will be to explain to the general public the principles and practice of sound forestry, and the extent and economic importance of the provincial forest resources (**3**; June, 1945).

The Yellow-headed Spruce Sawfiy [Hymen. (*Tenthredinidae*)], which does not appear to flourish under forest conditions, is becoming the most serious defoliator of Spruce trees growing in farm shelterbelts in the Prairie Provinces. Defoliation is often severe and artificial control methods have become necessary (**2**; May-June, 1940).

During the past 4 years the Entomological Laboratory at Victoria, B.C. has been investigating ambrosia-beetle damage in felled and bucked timber, employing a precise method of log analysis to determine whether there is a consistent relation between log species, time of felling, length of period on the ground, and the intensity of beetle attack and damage. Results so far obtained indicate the probability of being able to forecast degree of attack under given conditions (**9**; May-June, 1945).

A system of partial cuttings in which healthy, thrifty, fast-growing trees are retained as the basis for a second early cut, promises to build up resistance of Fir/Spruce forest to budworm (*Cacoecia fumiferana*) attack. The readiness, however, of owners and operators to adopt such cutting methods will depend largely on the increased costs involved. To obtain information on this point, a logging-cost study is being made by the Canadian International Paper Company near Lake La Rouche in the Upper Gatineau, Quebec, in co-operation with the Canadian Pulp and Paper Association as well as the Dominion and Provincial Governments. In addition to cost data, the experiment should provide valuable information on the effect of partial cuttings in areas where the budworm is building up its population, and on the capacity of various trees and forest types to recover from attack after the budworm has been eliminated (**9**; May-June, 1945).

There is no lumbering industry in the Mackenzie District of the North West Territories but the area is fairly well forested and supplies lumber for local needs. Much of the region contains scrub forest of no present economic value, but there are merchantable stands along the Slave and Liand Rivers. The value of the forest is largely as cover for game. Forest fires have become more numerous and larger in recent years and a forest fire protection system was established in the District during 1945.

No estimates are available of the amount of reserve timber, but it is known that present cutting rates are having little effect upon the total forest production. In 1943-4 the total cut amount to nearly 1 million bd. ft., ¼ million linear ft., and 11,000 cords, plus nearly 5 million bd. ft. and 16,000 telephone poles for the Canol Project (**4**; July, 1945).

Ceylon. The tree-planting campaign in Ceylon has met with great success, and a similar campaign is to be carried out in the next two years. It is estimated that already more than 100,000 *Areca catechu* seedlings have been planted. Timber of this species has been much used during the war (**14**; 4.8.45).

Costa Rica. A rubber plantation of 2,500 acres in Costa Rica is on soil so rich that the trees mature as much in 4 years as they do in the Netherlands Indies in 5 years. Moreover, it has been found that interplanting the rubber trees with corn greatly benefits their growth and incidentally helps to defray labour costs, which are higher in Costa Rica than in the Far East (8; 21.7.45).

Finland. Before the war, Finnish exports of sawn timber averaged about one million standards a year. For 1945 the whole available stock of sawn goods is estimated at half a million standards, of which 300,000 will be required for local consumption and fulfilment of war reparations, leaving only 200,000 for export (**14**; 28.7.45).

French West Africa. The principal forest resources are located in the tropical-rain-forest bell of the Ivory Coast. For the Federation as a whole the normal capacity of the sawmill industry is 70,000 cu. m. of logs annually, but in 1944, owing to shipping shortages and lack of new capitat equipment, only 37,000 cu. m. were sawn. Owing to the shortage of coal, petrol and fuel oil, a considerable quantity of wood was used during that year as fuel for the railways and producer-gas vehicles. A survey and classification of forest land is under way, to determine the extent of the colony's timber resources, and substantial areas have already been reforested. It is said that if modern equipment, such as is used in the United States, were employed in the Ivory Coast, production could be increased to 1½ million cu. m. annually and costs reduced to $17.00 f.o.b. per cu. m. (8; 23.6.45).

Gambia. In view of the construction of new villages and the possible expansion in the colony, the Standing Advisory Committee on Development and Welfare have urged the Government to embark on an active forest policy, to demarcate selected areas and to define a forest programme for reservation and afforestation. Excessive felling is endangering the future productivity of the Colony's forests (**7**; August, 1945).

Greece. Indiscriminate felling of trees in certain areas of Greece during the 3⅓ years of enemy occupation caused very considerable damage to the country's Pine forests. Very often forests were first set on fire and the stumps were then cut and sold either as firewood or in the form of charcoal (**6**; 1945).

Before the war, Greece produced an average of 55,000,000 lb. of Pine gum per annum. With a 40-per-cent. reduction in the number of workable trees this year's (1945-46) production is not expected to exceed 33,000,000 lb. Comparatively little damage was suffered during the war by the 25 gum-processing plants in Greece, which after minor repairs could all re-start operations. About half these plants are in the vicinity of Athens, others are in Euboea, in northern Pelopennesus and near Salonika (**6**; 1945).

Guatemala. Mahogany production is shifting to the northern province of Peten, which is heavily forested but up to recently was inaccessible and little explored. Roads have now been built and camps established, and in 1944 Mahogany production in the province was 5 times as great as that in 1943 and provided 85 per cent. of the total output of the country (8; 8.8.45).

Haiti. During 1944 the Société Haitiano-Américaine de Développement Agricole (SHADA) abandoned the cultivation and production of *Cryptostegia* [cf. *For. Abstr.* 6 (108, 186)] and cleared the land. A total of more than 36,000 acres had been planted and an additional 64,000 acres cleared for planting (8; 2.6.45).

Jamaica. In order to obtain data on the economic importance of termites in the Colony, an entomological survey of all the houses was recently carried out by the staff employed on the General Census. The data obtained are being computed, and the results are expected to provide useful

information which will serve as a basis for the technical officers of the entomological services to carry out a micro-census (**11**; 1945).

Kenya. The production of Cedar pencil slats seems likely to be a promising timber export industry in Kenya Colony after the war. Formerly all the best slats were made from American Cedar (*Juniperus virginiana*) but supplies of this are now very short. The Kenya Cedar (*Juniperus procera*), one of the commonest trees in the country, is a very similar wood. It is a fact that East Africa, mainly Kenya, is almost the only remaining source of genuine pencil cedar, and sufficient is being replanted in the Colony to ensure the maintenance of supplies (**18**; September, 1945).

Mexico. The exploitation of the Acebuche (*Forestiera spanova*) or Wild Olive tree for firewood has been prohibited in the States of Michoacan and Jalisco, and in the municipal districts of Ixmiquilpan and Actopan in the State of Hidalgo, by an Executive decree published 23rd May, 1945. The purpose of the decree is to prevent the further destruction of this source of vegetable oil. The decree also provides that the Secretariat of Agriculture shall send out workers to graft shoots from certain oil-producing varieties of plantings in Michoacan on to the Wild Olive trees in the various regions. After the Acebuche trees have been grafted, their development is to be under the control of the Dirección General of Agriculture (**8**; 16.6.45).

Exports of turpentine and rosin from Mexico to the United States were reduced in 1944, owing mainly to the lower output resulting from damage caused by the eruption of the new volcano Paricutin. Many trees were killed and others damaged over a wide area (**8**; 16.6.45).

Morocco. A largely undeveloped asset of Spanish Morocco is its forests, which are found principally in the mountainous region adjacent to the Algerian frontier. The 1942 production figures are the latest available, but output in 1943 and 1944 is believed to have continued at approximately the same level. Log production amounted to 38,820 metric tons in 1942; the output of sawn wood was 4,477 cu. m. (**8**; 9.6.45).

Nigeria. Production of palm oil and palm kernels is a vital part of Nigerian economy. Out of a population of 22 millions between 3 and 4 millions in the densely populated western and eastern provinces depend entirely on this source of wealth as their sole means of livelihood. At one time the world demand for palm oil was supplied entirely from Nigeria but there is now increasing competition from Malaya, the Netherlands East Indies and the Congo, which together are estimated to produce 530,000 tons in 1948 as against 144,000 tons in Nigeria. Competition is also present in the quality of the oil, which is judged by the content of free fatty acids, only oil with a low content of these acids being used for edible purposes. In terms of percentage of free fatty acids, the oil of Nigeria is relatively inferior. Two-thirds of the oil extracted by the cruder local African methods contains between 6 and 25 per cent. free fatty acids and the remaining third contains more than 25 per cent. The plantation-grown product of the three competing territories will average in the post-war years less than 2 per cent. free fatty acids. In Nigeria the only oil to reach this standard is the relatively small amount produced from plantations. The Nigerian Palm Oil Research Station report for 1942-43 assessed the yield of oil from the cultivated palm at 50 per cent. higher than that from the wild palm.

In addition to its export value, palm oil forms part of the basic African diet. Exact statistics are not available, but roughly as much oil is consumed within the country as is exported, or about 130,000 tons a year.

The three competing territories have achieved their success by concentrating on plantations with an ideal density of trees, cultivated palm seed selection, and mills with the most up-to-date equipment. There are 4 main methods of extraction. On the basis of 2¼ million tons of fruit the ordinary African method recovers about 55 per cent. of the oil present or 243,000 tons, the simple hand-press method gives a return of 65 per cent. or 287,000 tons, while the large factory mill extracts 93 per cent. or 418,000 tons.

The Nigerian Government and commercial concerns are alive to the situation. Research work in plantation growing at stations and on demonstration plots is being carried on. The problems of locating and installing various types of plants, ranging from the hand-press to the pioneer mill, are being explored. Education of the African grower is essential but difficult (**16**; 31.10.45).

Northern Rhodesia. It is suggested that the production of Eucalyptus oil for use in the flotation process of copper extraction, as a substitute for imported Pine oils, would provide employment for Africans in an area where at present the production of cash crops is impossible (**7**; July, 1945).

South Africa. The doubling of the present (15,000 acres of) Government plantations in South Africa and the employment of ex-Servicemen interested in forestry are stated to be among the plans of the Department of Forestry for its post-war programme. Farmers are realizing the value of planting trees on areas not suitable for agricultural purposes, and the number of plantations on farms is increasing rapidly. The Forestry Department is establishing a large timber-research station at Bellville, 12 miles from Cape Town. It is hoped to have the station working in the early months of 1946 (**18**; September, 1945).

The South African Government has prohibited further fellings of Stinkwood (*Ocotea bullata*) in order to preserve forest shade and enable seedling trees to reach maturity and so in time replace the heavy fellings made during the war (**18**; August, 1945).

Surinam. Balata (a latex now used mainly for belting and golf balls) is obtained in Surinam by tapping the Bulletwood trees (*Mimusops balata*) which are found in large numbers in its forests. The trees are either cut down and bled, or tapped and left for a second tapping. Few survive the second tapping, and some are killed by the first. Unless some attempt is soon made at replanting, it appears to be only a matter of time before the balata industry of Surinam is doomed. The highest production of balata in Surinam was in 1913 when 1,180 tons were produced and exported. This was the production of about 6,000 men. At present not more than 300 men are in the field and the 1945 production was expected to be about 150 tons (**8**; 25.8.45).

Sweden. The wallboard industry in Sweden is relatively young, the first mill having begun production in 1929, using the Masonite method with a capacity of 5,000 tons a year. In 1939 ten mills were in production, three have been added since, and another is under construction. The pioneers of wallboard production had in mind the use of certain forest and sawmill waste, but competition forced producers to employ higher-grade raw materials, and the wallboard industry is now a serious competitor for wood with the cellulose industry. The estimated full peace-time capacity for the industry is 90,000 tons of porous board and 160,000 tons of hard board (**14**; 22.9.45).

Tanganyika. A grant of £100,000 for the development of a Cinchona research organization has been made under the Colonial Development and Welfare Act. The new organization will be based on the East African Research Institute at Amani. Considerable progress is reported in the production of totaquina, started in Tanganyika in 1942. The dried bark is powdered, treated with lime water and extracted in an oil from which the alkaloids are obtained by acid treatment (**5**; July, 1945).

The amount of totaquina sold in the last half of 1944 was twenty times that sold in a similar period of 1942. Totaquina is a mixture of the alkaloids from the bark of various species of *Cinchona*, and since the shortage of quinine it has been increasingly in demand. Manufacture was started at Dar-es-Salaam in 1942, and the factory is now supplying Kenya and Uganda with totaquina which is surplus to the present requirements of Tanganyika (**7**; 1945).

Trinidad. Clearing of the original forests has not proceeded as fast in Trinidad as in other West Indian colonies and nearly half of the island is still forested. In 1944 the value of forest products and of industries such as match-making and furniture-making, which use locally-grown wood, was nearly 4 million dollars compared with 1½ and 6 million dollars respectively from the subsidized cocoa and sugar industries. The following table shows production of lumber and firewood (including charcoal) for the 6 years 1939-44, a production which was accompanied by an increase in the number of sawmills from 20 to 42, with 7 more being erected or planned.

	1939	1940	1941	1942	1943	1944
Timber (bd. ft.) ..	8,500,000	12,000,000	13,500,000	15,750,000	20,750,000	18,000,000
Firewood (cu. ft.) ..	1,250,000	1,500,000	2,000,000	2,250,000	2,500,000	3,250,000

There was also a large production of piles, railway sleepers and fence posts. Wood of the Jereton tree (*Didymopanax morototoni*) is used for the local match industry.

In spite of greatly increased production, there is no danger of exhausting the forest resources; cutting is carefully controlled in all Forest Reserves, and in some Crown Land forests, by rules which forbid felling of immature trees of valuable species. Exploitation is made difficult by the extremely

mixed character of the forests, which consist largely of species useless for timber. Some of these are suitable for pulp manufacture but there is not a sufficient quantity readily accessible at a low price to make manufacture economically practicable. An exception is the Mora (*Mora excelsa*) which exists in pure, or almost pure stands. The Forest Department policy is to form timber plantations at a number of easily accessible centres. During the 6 years 1939-44, the Department has established 2,043 acres of Teak and 505 acres of mixed local species. The total area of plantations is now 5,546 acres, and 900 acres a year are to be established for the next 50 years (**7**; August, 1945).

United States. An experiment in the growing of the Amoor Cork tree (*Phellodendron amurense*) as a possible source of commercial cork has been started at the Oregon forest nursery. Little information is at present available on this Asiatic species, except that it appears to be hardy in climates similar to that of Oregon and has few soil requirements except that the soil must not be too wet. Another variety of *Phellodendron* will probably be planted next year, and also a species of Chinese Oak (*Quercus variabilis*). Investigation indicates that the regular Cork Oak (*Quercus suber*) will not grow in the State, but it is believed that the Chinese variety will thrive there, especially in the Williamette Valley (**3**; June, 1945).

By using square telephone poles, the U.S. Army Signal Corps has been able to save some 250,000 bd. ft. of lumber for every 100 miles of poles. It is reported that the square pole can be set up with greater ease than the usual round pole (**14**; 28.7.45).

Throughout the Pine region of the southern States there are millions of tons of Longleaf Pine stumps, many of which are now being processed in turpentine and rosin plants in Louisiana and Maryland for the extraction of Pine oil, acetone, rosin, camphor and vanillin. Other chemical substances, which have tended to concentrate in the Longleaf Pine stump since it was cut 25 or 30 years ago, have been isolated by research chemists, and many believe that around these stumps an independent chemical industry can be built, which would include the manufacture of synthetic rubber and plastics (**10**; May-June, 1945).

Steps towards the establishment of a pilot plant for research into processes for the conversion of hardwood wastes into fibrous products were taken by the Committee on Hardwood Research Administration, American Forest Products Industries, Inc., at a meeting in Washington, 20th April, 1945. It is expected that the pilot plant will be located at first in the District of Columbia, until commercially applicable processes have been developed. The chief chemist reported to the committee on processes being investigated at the Timber Engineering Company Laboratory for producing paper, cardboard, and building board from hardwood waste. The method evolved consists of chemical pulping under very mild conditions. The product is a fibre stock which can be further converted into cardboard and wall board materials, besides serving as part of the furnish in papermaking and also as a base for plastic moulding. The wood should be in the form of small pieces, for example, the hardwood waste obtained in veneer plants (**12**; June, 1945).

Elm trees resistant to the Dutch Elm disease are being rapidly propagated at the Dutch Elm disease laboratory in New Jersey where a selection of American Elm and two hybrids were found to be immune to the disease. Elm seedlings produced by old Elms in Kentucky, which survived an outbreak of phloem necrosis more than 50 years ago, have shown marked resistance to that disease. The House of Representatives has granted $20,000 for work on hybridization and selection, using these resistant strains to produce an Elm immune to both these serious diseases (**1**; 1.6.45).

The Forest Resource Appraisal, an elaborate survey of the effects of the war on the forests of the United States and the condition of the remaining timberlands, was started in January, 1944, and is already producing useful data. It is supported by some 700 industrial undertakings and sponsored by the American Forestry Association. The survey will be made by counties and the completed reports will include data on forest area by class of ownership, types, age classes, condition of stand, character of management, standing timber volumes, current drain in recent years, estimate of probabl yield in the next decade, extent and effectiveness of fire protection, forest-industry plants, forest management trends, land-use trends, taxation and forest laws (**15**; June, 1945).

The Forestry Research Foundation, a non-profit-making trust for collection, management and dispersion of gifts and funds in the field of forest research, came into being in Oregon on 28th March, 1945. The Foundation had as its model the University of Wisconsin Alumni Foundation, which was created to patent and exploit any article, process, or application which might be discovered by

men of the faculty or research students working in time which was paid for by the University. Individuals in such circumstances would not own the patents they had created, and the University as such was unable to act in the patent field. Similar conditions existed in other States. The Foundation, therefore, takes over the right to patent and exploit such ideas, with accruing income reverting to the institution for which the trust is created.

Research which results in production of commercial implements or processes, whether by employees of the Oregon State Forestry Department or by those engaged at the Oregon Forest Products Laboratory, can in future be handled by the Forestry Research Foundation, and all legal obstacles with which the State might have to contend, will be evaded (**17**; June, 1945).

The United States Government has decided to renew its efforts to establish a privately-owned-and-operated pulp-manufacturing industry in Alaska and offers 14 million cords (about 7½ billion ft.) of Hemlock and Spruce in the neighbourhood of Ketchikan, Alaska for a sulphate, sulphite or newsprint plant. Much greater amounts than this are available and eventually, under Government-imposed forest-management regulation, a total of 140 million cords of timber (78½ billion ft.) in the Tongass National Forest may be utilized by forest industries. It is estimated that this forest of 16,073,000 acres could produce on a perpetually sustained yield basis a total of 800,000 tons of sulphate or sulphite paper a year. An Alaskan pulp industry would have an almost year-round logging season, cheap log transportation along protected sea channels between the woods and the mill, ocean shipping, water power for mill operations and an equable climate that permits of unhindered mill operation throughout the year. Precipitation is very heavy and keeps down the threat of fire in the forest. The following is a conservative estimate of the volume of commercial timber by species in the Tongass National Forest.

Species	*bd. ft.*	*per cent.*
Western Hemlock	58,000,000,000	74
Sitka Spruce	15,800,000,000	20
Western Red Cedar	2,350,000,000	3
Alaska Cedar	2,350,000,000	3
Total	78,500,000,000	100

(**13**; May, 1944).